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ANALYSIS OF MANNING DECISIONS AND CONCEPTS UTILIZED FOR THE FFG--ETC(U)

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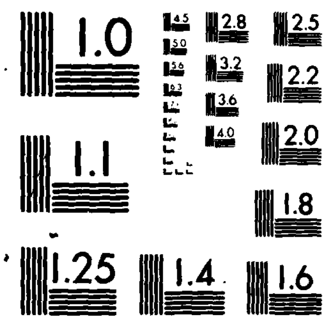

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THESIS

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AND CONCEPTS UTILIZED
FOR THE FFG-7 CLASS SHIP.

by

Richard Ray Arnold

~~and~~

Robert William/Barrie

June 1980

Thesis Advisor: R. E. Elster

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80 10 21 015

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER

2. GOVT ACCESSION NO. AD-A091093

3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle)
Analysis of Manning Decisions and Concepts Utilized for the FFG-7 Class Ship.

5. TYPE OF REPORT & PERIOD COVERED
Master's Thesis; June 1980

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)
Richard Ray Arnold
Robert William Barrie

8. CONTRACT OR GRANT NUMBER(s)

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Naval Postgraduate School ✓
Monterey, California 93940

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS
Naval Postgraduate School
Monterey, California 93940

12. REPORT DATE
June 1980

13. NUMBER OF PAGES
114

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

15. SECURITY CLASS. (of this report)
Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)
Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)
FFG-7 Class ship
Ship Manpower Documentation (SMD)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

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(20. ABSTRACT Continued)

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Analysis of Manning Decisions and Concepts Utilized for the FFG-7 Class Ship

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MASTER OF SCIENCE IN MANAGEMENT

from the

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The FFG-7 Class ship acquisition program began in 1970 and is scheduled to include more than 50 hulls, or about 20 percent of the Navy's surface ships, upon completion of the project in 1988. This thesis reviews the chronology of the FFG-7 Class and analyzes some of the major historical events in its development in an attempt to discover the reasons for increased manning and accommodation requirements. Analysis showed weaknesses in the manpower requirements determination process and in the coordination of ship acquisition managers with manpower planners and fleet units. Recommendations are presented to improve the ship manpower documentation (SMD) program and coordination of manpower planning, operational, and project design functions in the surface ship acquisition process.

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I. INTRODUCTION

A. BACKGROUND

In 1970, the U. S. Navy recognized that with the deactivation of many of its remaining World War II era destroyers, new ship acquisition programs were needed to provide the level of escort capability required in the 1980's and beyond. In November of 1970, Admiral E. R. Zumwalt, Chief of Naval Operations (CNO) and his staff developed a Navy shipbuilding concept providing a spectrum of ships representing a balance between smaller numbers of very capable ships to operate in high threat areas and large numbers of smaller, but effective, lower cost ships for less demanding tasks. The DD-963 Spruance Class was designed to help provide the high mix and the FFG-7 Class the smaller, but effective low mix (LOMIX).

The FFG-7 Class was designed for minimum manning, as that was one of the features of the LOMIX concept. During the design and concept phase of the FFG-7, a manning ceiling of 163 officers and enlisted men, and an accommodations limit of 185 bunks were developed. Today, the FFG-7 Class has 181 officers and enlisted men authorized, with a proposal in the Program Objective Memorandum (POM)-81 for additional billets. The Class is also currently undergoing an alteration to increase the number of accommodations onboard to 215 bunks.

B. PURPOSE

This thesis reviews the chronology of the FFG-7 Class and analyzes some of the major historical events in its development in an attempt to discover the reasons for such an increase in manning and accommodations.

C. SCOPE

Data and information were obtained through research of published literature, Navy FFG-7 Class documents, and of Navy correspondence. Interviews were conducted with many personnel involved with the FFG-7, and a one-week research trip was made to Navy organizations in Washington, D. C. and Norfolk, Va.

Chapter II of this thesis identifies the FFG-7 design constraints, its mission and characteristics, and the manning concepts developed by the designers to remain within the constraints. Chapter III focuses on the Navy's Ship Manpower Document (SMD) program and its impact on the FFG-7. Alternatives to the methodology used for this SMD program are also described. Chapter IV addresses the current status of the FFG-7 Class manning concepts, the trend toward a more experienced personnel force, and the Navy's efforts regarding manpower versus hardware procurement tradeoffs. Finally, conclusions and recommendations for future ship acquisition programs are addressed in Chapter V.

II. FFG-7 DEVELOPMENT

This chapter discusses the development of the USS OLIVER HAZARD PERRY (FFG-7) Class ship. The chapter is divided into three sections. The first section considers the three constraints placed upon the designers by the Chief of Naval Operations (CNO). The three constraints limited cost, displacement, and accommodations. The second section describes the ship's mission, its current characteristics and future additions to the ship. The final section addresses many of the manning concepts developed by the designers to remain within the constraints placed upon them. They include: (1) ship's organizational changes; (2) modifications of watchstations; (3) development of a Class Maintenance Plan (CMP); (4) establishment of a systems training concept; and (5) the use of the FFG-7 as a two-year leadship (i.e., FFG-7 was commissioned two years prior to other ships in the Class).

A. CONSTRAINTS

1. Design-to-Cost

Prior to 1966, the Navy's ship acquisition process was known as Design to Requirements. The proposed ship was designed by the Navy and then contracted with either private or Navy shipyards for actual construction. Ships were designed to meet performance requirements. From 1966

through 1971 ships were acquired through total package procurement. In this approach, the Navy was limited to concept formulation and contract definition. The ship design and construction was done by a private shipyard under a single contract. The Spruance (DD-963) and Tarawa (LHA-1) class ships were acquired under this total package procurement plan. In the early 1970's the total package procurement plan was replaced by the design-to-cost approach. The design-to-cost process is similar to the earlier design-to-requirements program, but cost is recognized as a design parameter in the new plan. Cost goals are established early during the ship design and are subjected to trade-offs with schedule and performance. The OLIVER HAZARD PERRY (FFG-7) Class was the first design-to-cost ship acquisition program. It was designed with a followship construction cost goal of $45.7 million and a threshold of $50 million in fiscal year 1973 dollars. The total class was to be procured over a period of five years [Nauta, 1978].

2. Displacement

The FFG-7 displacement goal was the second major design constraint. The DD-963 Class, under the total package procurement plan, had developed a 7,800 ton displacement. The Chief of Naval Operations (CNO), now using cost as a driving factor, was not going to allow the displacement of the FFG-7 to be as great as the DD-963 Class. In order to remain within the $45 million goal, the

CNO set a displacement goal of 3,400 tons and a limit of 3,600 tons fully loaded. Provisions have been made for proposed additions totaling an additional 50 tons, but any new equipment or modification over the 50 tons will force the removal of other equipment [Beecher, 1978].

3. Accommodations

Cost again played an important role in determining the number of accommodations on the FFG-7 Class ship. The CNO directed that there would be 185 bunks in order to reduce life cycle costs, particularly manpower. Standard Navy policy for new ship construction is to provide an accommodation margin of 10 percent over estimated manning requirements, including directed requirements such as staff embarkments and aviation detachments. For the FFG-7, the CNO approved a five percent accommodation growth margin. The purpose of the margin is to allow for future growth over the lifetime of the ship. The FFG-7 leadship experience has caused 30 additional bunks to be added to the ships in the Class. This addition is at the expense of crew habitability [Nauta, 1978]. The bunk alteration will be conducted as follows: (1) FFG-7 during their second Selected Restricted Availability (SRA); (2) FFG-8 through 18 will have additional bunks installed during their first SRA; (3) FFG-19 through 34 during their Post Shakedown Availability (PSA); and (4) FFG-36 and later followships will have additional bunks installed during construction

[Naval Sea Systems Command, 1980]. This accommodations constraint has caused many of the concepts, delineated in the Concept section of this chapter, to be developed. How the Navy was able to meet, through the design and production phases, the 185 bunk limitation is discussed in the Ship's Manpower Document (SMD) portion of this thesis.

B. MISSION

The mission of the FFG-7 Class is to conduct worldwide combat operations at sea, in support of national policy. The ship will supplement planned and existing escorts in the protection of underway replenishment groups, amphibious forces, and military and mercantile shipping against subsurface, air, and surface threats. The ship will also contribute to sea control and to a lesser degree sea denial in order to ensure our use of essential sea lanes of communication and trade [FFG-7 Class Maintenance Plan Doctrine, 1979]. This ship is not required, by design, to fulfill missions such as to escort carrier task forces, which are appropriate for much larger and faster ships, i.e., the multipurpose destroyer.

C. SHIP CHARACTERISTICS

The FFG-7 Class ship is a single-screw, gas turbine-powered guided missile frigate comparable in size to the USS BROOKE (FFG-1) Class, but manned by a significantly

smaller crew. The combat systems department has been designed for optimum operation under minimum manning conditions. Two AN/UYK-7 digital computers integrate the ship's command and decision system with the ship's weapon systems. In addition to standard AN/UYA-4 consoles at the radar tracker and antisubmarine air controller positions, the command and decision system includes operations summary consoles for the tactical action officer (TAO) and antisubmarine warfare evaluator. The combat information center operates in a Navy tactical data system (NTDS) environment with standard symbology, real-time data analysis, and computer programs designed to provide quick reaction defense throughout the multi-threat spectrum [Duich, 1978].

The main propulsion system includes two LM 2500 gas turbine engines driving a single controllable and reversible pitch propeller through a conventional main reduction gear and shafting assembly and a Navy-unique, synchronized, self-shifting clutch. A computerized propulsion control system provides a semi-automatic control with digital displays and data printouts, while programmed throttle and pitch control is available in the central control station and on the bridge. Ship service electric power is supplied by four 1000KW 60 HZ diesel-driven generators and three 400 HZ static frequency converters [Nauta, 1978].

The ship is a conventional, two-deck, longitudinally framed steel destroyer with an aluminum deckhouse.

Displacement at full load is 3,645 tons, including space and weight reservations for planned growth. The sustained speed of the ship at full power is in excess of 27 knots. Other characteristics of the FFG-7 Class are as listed in Table I [FFG-7 Class Maintenance Plan Doctrine, 1979].

D. CONCEPTS

The CNO wanted the FFG-7 Class frigate to have increased operational availability over current ships in the fleet, and he wanted it to have minimum manning [FFG-7 Class Maintenance Plan Doctrine, 1979]. This was in addition to the three constraints of cost, displacement, and accommodations described earlier in this chapter. In order to meet the desires of the CNO, designers had to modify several traditional concepts. They included: (1) ship's organizational changes; (2) modification of watchstations; (3) development of a Class Maintenance Plan (CMP); (4) establishment of a systems training concept, and (5) the use of the FFG-7 as a two-year leadship.

1. Ship's Organizational Changes

The traditional frigate is organized into the following departments: operations, weapons, supply, aviation, administration, and engineering. The FFG-7 Class has instead: combat systems, ship control/communications, support, aviation, and engineering departments as shown in Table II. The only officers assigned to the ship

TABLE I

SHIP CHARACTERISTICS

Length, waterline	408 feet
Length, overall	445 feet
Beam (maximum)	47 feet
Draft (full load)	24.5 feet
Missile launchers	One single launcher (MK 13 Mod 4) for Standard and Harpoon missiles
Guns	One MK 75 Oto Melara (76 mm) rapid fire gun
Antisubmarine weapons	Two MK 32 triple torpedo mounts with MK 45 ASW lightweight torpedoes
Helicopters	Two light airborne multi-purpose system (LAMPS I or II)
Sonar	SQS-56 direct path sonar
Radar	SPS-49 long range air search radar MK 92 Mod 2 fire control system SPS-55 surface search radar

In addition, the following items are planned for subsequent followships and retrofit onto current FFG-7 Class ships [Nauta, 1978]:

Vulcan/Phalanx close-in weapon system.
Lamps III completely replacing Lamps I.
Link 11 tactical data transfer system associated with Lamps III.
Tactical towed array sonar (TACTAS).
Helicopter recovery and transfer system, and
Fin stabilizers.

TABLE II

FFG-7 SMD DEPARTMENT/DIVISION ORGANIZATION

COMMANDING OFFICER
CDR

EXECUTIVE OFFICER
LCDR

ADMIN ASS'T
YNC HM1
PN1 EN MA1

SHIP CONTROL/ COMMUNICATION DEPT (SC) LT	COMBAT SYSTEM DEPT (CS) LT	AVIATION DEPT (AV) LT	ENGINEERING DEPT (E) LT	SUPPORT DEPT (S) LT
SHIP CONTROL DIV (SC-1) OMC	CIC DIV (CS-1) LT	HELO DETACH-MENT	MAIN PROPUL-SION DIV (E-1) MPA	SUPPLY DIV (S-1) SKC
COMMUNICATION DIV (SC-2) (DEPT HEAD) LT	ASW DIV (CS-2) LTJG		DAMAGE CONTROL/ AUXILIARY DIV (E-2) ENS	SUPPORT DIV (S-2) MSC
DECK DIV (SC-3) BMCM	ORD DIV (CS-3) LTJG			
	ELECT READI-NESS DIV (CS-4) LTJG			

control/communications, and support departments are the department heads. The role of the division officer is assumed by the senior enlisted petty officer in each division. The FFG-7 deck division also has its differences from tradition. Personnel in this division stand no underway watches. A new (as compared to earlier classes of ships) facilities maintenance (FM) program increases the division's responsibility not only for deck and seamanship evolutions, but for the cleanliness and maintenance of all topside and common-use spaces as well. The division is equipped with various labor-saving devices such as spray wax buffers, wet and dry vacuums, high-pressure washers, and longer lasting paint. In the engineering department most propulsion, electrical, and damage control equipment is started and operated by a two-man watch in the central control station. In addition, two rovers (forward and aft) patrol and monitor the unmanned auxiliary machinery systems and equipment. The support department is designed to incorporate a traditional supply organization with as many of the ship's administrative functions as possible. Advances in the support supply area include a central galley which serves the enlisted dining facility, the chief petty officer mess, and the wardroom. A stores elevator which moves foodstuffs from the main deck to storerooms and ammunition to the Oto Melara gun magazine eases the labor requirements for food and ammunition-

handling working parties. A central supply storeroom which contains aviation-style drawer cabinets for the stowage of repair parts is located below the flight deck for ease in the transfer of stores during replenishment operations. Still another change is the incorporation of a central office complex. Within this single space is located the ship's administrative office, the combat systems department office, the engineering log room, the support office, and the ship control/communications department office. This central office also has control of the general announcing system for the daily routine of the ship [Duich, 1978].

2. Modification of Watchstations

A traditional bridgewatch consists of two officers and between 11 and 13 enlisted personnel. The Proposed Ship Manning Document (PSMD) for the FFG-7 Class requires a watch team of one officer and five enlisted personnel in the bridge area. This concept was based on two proposals [Nauta, 1978].

First, all ship control functions should be integrated into a ship control console, the operation of which is controlled and monitored by one enlisted console operator and the officer of the deck. The second proposal was the development of a ship control rating combining the functional duties and knowledge of the quartermaster, signalman, and boatswain mate ratings. The personnel

would then be trained and qualified in a broad range of skills to obtain cross-utilization within a functional area. Additionally, the auxiliary machinery spaces were automated to eliminate the requirement for a watchstation [Nauta, 1978].

3. Class Maintenance Program

The FFG-7 Class also requires a non-traditional maintenance strategy in order to fulfill its objectives. The maintenance strategy adopted for the FFG-7 Class includes several unique characteristics [FFG-7 IMAV/SRA Major Modernization Plan, 1980].

The first of these is the recognition that many maintenance tasks required for the FFG-7 can be estimated. These maintenance actions have been combined into a document called the Class Maintenance Plan (CMP) from which all ships' maintenance availabilities will be planned. The CMP relies upon feedback from the fleet to ensure that its estimates are correct.

The second characteristic of the FFG-7 maintenance strategy is that all intermediate and depot maintenance is expected to be accomplished during more frequent availabilities of three to four week duration rather than at lengthy regular overhaul periods which last 6 - 12 months. This concept, known as progressive overhaul, is expected to keep the ship in a continually high rate of readiness and should prevent any general material degradation.

The third characteristic of the FFG-7 maintenance strategy is to make use of the CMP to anticipate equipment failure so modular replacement can be scheduled prior to the need for corrective maintenance.

The fourth and final characteristic is to make use of repair-by-replacement rather than conventional piece-part repair methods. This is designed to reduce maintenance time for the ship, because it should be necessary only to remove and replace (from a rotatable pool of equipment) a component rather than remove, trouble-shoot, repair, and reinstall. The trouble-shooting and repair of the removed components should be accomplished at rework sites ashore. Supporting this strategy, many of the ship's systems have built-in test and fault detection/location capabilities. Other design features include easy access for installation and replacement and modular construction for segmented removal. Further support for this strategy is evidenced in the upgrading of the afloat and shore intermediate maintenance activities (IMA) by providing: (1) Skills--Eleven unique Navy Enlisted Classification (NEC) codes will be assigned to all IMA's in the FFG-7 Class homeports; (2) Tools for hydraulic repair, micro-electronic repair, hydraulic/electro-hydraulic/pneumatic controls, battery charging and repair, expanded capabilities in calibration, sensor, and testing, and fire control system repair; (3) New test equipment; (4) Complete sets

of technical manuals and ship's plans on microfilm at each IMA in FFG-7 homeports; and (5) Deployment support in the Mediterranean Sea which is planned to include a FFG-7 support group located in Naples, Italy, and civilian personnel at Ship Repair Facilities (SRF) Subic Bay, Philippines and Yokosuka, Japan who will receive training in FFG-7 support [FFG-7 IMAV/SRA Major Modernization Plan, 1980].

4. Systems Training Concept

Training is also an area where the FFG-7 has had an impact on traditional concepts. Each man is expected to be able to perform his operational and maintenance tasks when he reports for duty. To manage efficiently the distribution of men possessing certain FFG-7 unique qualifications, 19 new Navy Enlisted Classifications (NEC) codes have been developed and approved. Eleven of these NECs will also be assigned to IMAs. These billets have been directed by CNO to be manned to both quality and quantity. In addition, 67 billets should be manned to quantity in the rating specified, but without regard to pay grade. Deficiencies in pay grade and experience levels in manning those 67 billets should be compensated to the maximum extent possible through NEC training pipelines [FFG-7 Class Maintenance Plan Doctrine, 1979]. The remaining 67 billets are to be manned in accordance with fleet manning policy. This selective manning concept

described above applies to only commissioning crews. FFG-7 training pipelines are to be used to accommodate replacement crews [FFG-7 Class Maintenance Plan Doctrine, 1979].

Because the ship class continues to evolve and require new and/or additional skills, each of the ship's departments is structured on a systems concept. The system organization is based upon a progressive hierarchy of skills and knowledge. The system is stratified into the senior systems technician (SSTs), the senior enlisted technician (SET), the subsystem technician, and subsystem component technician, which include the apprentice technician. While this approach allows for orderly growth and development of personnel, the application of the system organization concept is predicated upon equipment standardization among platforms and well-defined tactical and managerial objectives for the class. This stratification allows for the development of systems technicians in pipelines that call for little or no personnel cross-utilization or equipment cross-training [FFG-7 Class Maintenance Plan Doctrine, 1979].

In ships of the FFG-7 Class only the combat systems and engineering departments require senior systems technicians. Their responsibilities bridge traditional officer management and strong technical experience. It is intended that the SSTs perform their assigned duties without

supervision. The senior enlisted technicians are specially selected individuals, pay grade E-6 and above, whose qualifications are a combination of technical/ non-technical training and experience. It is intended that the SET perform under supervision, however, the functions of the SET in a department not having SSTs may be expanded at the discretion of the division officer. It should be noted that under current manning constraints, individual billets may be filled one rating above or below the rating specified in a ship's SMD. In the case where less than an E-6 is available, he may be assigned as the SET and be nominated for system-level training as soon as possible.

A subsystem technician should be an individual knowledgeable in all prescribed subsystem standards of performance, modes of operation, subsystem alignment, test procedures, documentations, and the designed inputs/ outputs of subsystem components. The individual should be capable of directing and functionally integrating, under supervision, all subsystem components through maintenance tests and operational procedures to achieve performance standards meeting design specifications. A subsystem-component trained technician or apprentice technician performs under supervision and should be knowledgeable in all prescribed system components standards of performance, modes of operation, test equipment, alignment, test

procedures, documentation, and the designed inputs/outputs and functional relationships of all components [FFG-7 Class Maintenance Plan Doctrine, 1979].

5. Two-Year Leadship

A concept taken from the aviation community, and applied to the FFG-7 Class acquisition program, is that of "fly before buy." USS OLIVER HAZARD PERRY (FFG-7) can be regarded as a prototype because of the two-year delay between the completion of FFG-7 and the completion on the next Class ship. To fully benefit from the "lessons learned" a leadship should be commissioned four to five years ahead of followships. Such a delay would be too long, however, because followships could be obsolete before being commissioned. There is more to the "fly before buy" concept than merely the two-year delay. A major test and evaluation program including the construction of two land-based test sites was conducted. All major component systems were tested independently before the first ship was finished. A replica of the FFG-7 Class shipboard combat information center (CIC) and radar equipment rooms were installed at the combat systems land-based test site at Islip, New York. Fully operational consoles, radars, antennae, and computers were installed as in the original configuration. Only the gun, missile launcher, and sonar systems were simulated. The site conducted many trials prior to the systems being placed aboard the OLIVER HAZARD PERRY. Similar trials were

conducted at the prototype plant of the gas turbine propulsion system at the Philadelphia division of the Naval Ship Engineering Center. This land-based test site duplicated the entire main propulsion gas turbines, reduction gear, controllable pitch propeller, and propulsion control system. Simulated missions were carried out using power and speed profiles that would be expected in actual operating conditions. The only parts missing are the propeller blades. The Department of Defense now requires that all major systems acquisitions be made on a "fly before buy" basis [Beecher, 1978].

E. SUMMARY

The commissioning of the USS OLIVER HAZARD PERRY (FFG-7) took place on 17 December 1977 in Bath, Maine. This ship represents a break with tradition (as described earlier in this chapter). How these constraints and concepts have impacted upon the Fleet and the "lessons learned" for future followships is discussed in Chapter IV of this thesis.

III. SHIP MANPOWER REQUIREMENTS DETERMINATION

Determination of manpower requirements is an essential function for our nation's armed services. Manpower and its associated costs are among the many resources the armed services must compete for within the federal budgetary and allocation processes. To avoid inefficient manpower resource allocations some appropriate methodology must be devised and then utilized to determine manpower requirements. Historically, the United States Navy has relied upon many years of experience and good judgment to serve as the methodology for manpower requirements determination. This methodology based upon experience and judgment became more difficult to defend to those responsible for providing the support of manpower requirements as more sophisticated methods became available in civilian industry [Requirements Determination Processes, undated].

The Ship Manpower Documentation (SMD) program was initiated in 1966 to provide the methodology for manpower requirements determination of the Navy's operating ships. The SMD program, coupled with the Squadron Manpower Documentation (SQMD) program for aviation units, and the Shore Requirements Standards and Manpower Planning (SHORSTAMPS) will provide the means of determining the Navy's manpower needs [Requirements Determination Processes, undated]. This chapter will focus on the SMD program for determining

the manpower requirements of our operating surface ships. It will examine the methodology, assumptions, strengths and weaknesses of the SMD methodology. Several alternative methods of determining and estimating manpower requirements for new, proposed, and existing ships will also be examined. The OLIVER HAZARD PERRY (FFG-7) Class and its manpower requirements determination will be used as an example for analysis of the SMD program and for some of the other requirements determination methods.

A. SMD PROCESS

Manpower requirements determination and the SMD methodology for that determination begin during the early design phases of a ship acquisition program. The Ship Acquisition Project Manager (SHAPM) from NAVSEA is assigned the task of determining manpower requirements for his ship. The SHAPM is able to request the preparation of the Preliminary Ship Manning Document (PSMD) from several sources; various contractors, the Personnel and Training Analysis Office (PATAO), or a division of NAVSEA. Regardless of the organization preparing the PSMD, it is developed and presented in accordance with OPNAV 10P-23, Guide to the Preparation of Ship Manning Documents, Volume I, Policy Statement [Betaque, Kennelly & Nauta, 1978]. OPNAV 10P-23 is the basic document for the SMD process. It provides the rules, assumptions, and formats

to be used in the formulation of all SMDs. The PSMD, although always subject to review and revision, remains in force until the SMD is approved for the operating ship. Recommendations for authorization changes in the PSMD are initiated by the SHAPM until the ship is commissioned, at which time the Fleet Commander assumes his normal responsibility and authority to recommend such changes [Betaque, Kennelly & Nauta, 1978]. The Deputy Chief of Naval Operations (Manpower Planning and Programming), OP-11, manages the SMD program and is responsible for the preparation of SMDs. In the case of PSMDs, however, OP-11 only comments on and endorses those PSMDs submitted by the SHAPMs to the CNO.

The formulation of an SMD to replace the PSMD begins approximately one year after the ship is commissioned. Specifically, the ship is scheduled for a manpower requirements survey team visit during the months immediately following completion of the post shakedown availability (PSA). During the PSA, problems identified during the shakedown and trials of the ship are corrected. After the PSA, the equipment aboard the ship and the manpower requirements to operate and maintain them should remain somewhat stable. The survey teams from the Navy Manpower and Material Analysis Centers, Atlantic or Pacific (NAVMMACLANT, NAVMMACPAC), visit the ship in order to determine manpower requirements in accordance with the

standard SMD methodology. A draft SMD is subsequently developed and forwarded to the ship and the chain of command for review prior to an on-site review and publication as an OPNAV instruction [CNO (OP-124E), undated]. This part of the SMD process is commonly referred to as the validation of the PSMD. Final approval of an SMD is by the DCNO (Manpower). Ships are surveyed and SMDs adjusted after the regular overhaul (ROH). It is in the ROH that modifications or equipment changes which affect manpower requirements are likely to occur. The ships are generally surveyed at the beginning of overhaul to ensure inclusion of equipment and configuration changes. This program for documenting ship manning requirements during overhaul represents the second generation ship manning document program or SMD II [Requirements Determination Processes, undated]. The SMD program also provides for interim changes to the SMD between overhauls which are usually requested by the ship and submitted through the operational chain of command to the fleet commanders for approval.

1. SMD Terms and Assumptions

OPNAV 10P-23 and other reference publications list and explain the terms and assumptions that are used in the SMD program for manpower requirements determination. Many of these assumptions also apply to the alternative methods. Terms and assumptions germane to the Navy's

manpower determination efforts will be discussed in this section.

First, the SMD methodology assumes a readiness condition I/condition III operating scenario. These scenarios describe a wartime steaming situation during which the ship is expected to perform all assigned tasks in a three-section watch indefinitely, to be able to attain full combat capability in condition I for periods of up to 24 hours, and to sustain condition III for an indefinite period. All assigned maintenance is expected to be accomplished in this scenario. The condition I/condition III operating scenario assumption is made for all ships except repair ships for which the SMD process assumes an inport scenario.

The SMD process determines shipboard manning needs based on the analysis of three functional requirements: operational manning, maintenance manning, and own-unit support. Operational manning is the qualitative and quantitative sum of billets needed to man all operating stations during a specified condition of readiness, such as condition I or III. Statements of those capabilities considered necessary for a ship to accomplish assigned missions under various conditions of readiness are contained in the Required Operational Capabilities (ROC) and Projected Operational Environment (POE) developed for

each ship type or class by the cognizant warfare sponsor [CNO (OP-124E), undated]. These statements from the applicable ROC and POE assist the identification of the operating stations which must be manned for the various conditions of readiness. Maintenance manning reflects the manpower needed to perform required preventive, corrective, and facilities maintenance (housekeeping and preservation). Own unit support is the manpower needed to perform administrative military, resupply, food service, hygienic, and other service tasks in support of unit personnel and equipment. The merging and summation of these three areas results in the organizational manning required for the ship. Organization manning constitutes the level of manning adequate to attain full combat capability in condition I, maintain condition III on a minimum three-section watch basis at sea, and provide for the accomplishment of ship's work in conditions III, IV and V [Requirements Determination Processes, undated).

Maintenance manning, as determined by the SMD methodology, is heavily dependent on the data and assumptions from the Maintenance and Material Management (3-M) system and the Preventive Maintenance Subsystem (PMS) program in particular. Preventive maintenance hours, which account for scheduled maintenance workload, are taken and summed directly from the Maintenance Requirements Cards (MRCs) for each system, equipment, or component aboard

[CNO (OP-124E), undated]. The hours listed on the MRC are the expected time that personnel of the appropriate rating and NEC with a thorough knowledge of the system, equipment, or component might require to perform the maintenance action. The time, rating, and NEC required for each maintenance action as well as how often maintenance actions are required are determined by the manufacturer's maintenance requirements for the equipment and Navy practices. PMS has a feedback opportunity for operating forces to recommend changes to existing PMS coverage. An allowance of 30 percent for Make Ready/ Put Away (MR/PA) time is added to MRC hours to obtain total preventive maintenance hours required [CNO (OP-124E), undated]. This allowance is for the time required to collect needed tools, don special protective clothing, clean-up, put away tools, etc.

Corrective maintenance is the workload associated with the restoration of disabled systems, equipments, or components to an operational condition within predetermined tolerances and limitations [CNO (OP-124E, undated]. The SMD methodology assumes that one hour of corrective maintenance will be required for each two hours of preventive maintenance. As an exception, in the case of electronics-associated ratings one hour of corrective maintenance is allotted for each hour of preventive maintenance.

Facilities Maintenance is the workload associated with performance of maintenance to preserve the hull, superstructure, and all equipments against corrosion or deterioration and to maintain cleanliness [Naval Sea Systems Command, 1975]. Facilities maintenance workload is primarily a function of area to be preserved and cleaned, and the anticipated frequency of such actions. OPNAV 10P23 states that the facilities maintenance man-hour requirements per unit of work are computed on the basis of work sampling data. Frequencies for these facilities maintenance actions are determined by Navy custom and engineering judgment.

A productivity allowance factor of 20 percent is applied to the maintenance manning requirements and other productive work requirements other than the operational manning of watchstations. This allowance is a rough estimate of the delays caused by fatigue, environmental effects, personal needs, and other unavoidable interruptions which increase the time required to accomplish work [CNO (OP-124E), undated].

Allowances are also made in the SMD process for service diversions and training requirements. Service diversions as defined for SMD use are those actions required of personnel by regulations or the nature of shipboard routine which must be, or are normally, accomplished during normal off-watch working hours, and which therefore

deduct from individual capacity to do productive work. The following types of activities are representative of service diversions: quarters, inspections, sick call, pay line, haircuts, business at post office, ship's store, personnel office, disbursing office, etc.

Training, for purposes of SMD development, is defined as activity of a practical or instructional nature which contributes directly to combat readiness or personnel effectiveness, but which otherwise detracts from individual capacity to accomplish productive work. The three categories of training normally considered during SMD development are formal training, proficiency training, and drills and practices. SMD methodology combines service diversions and training into a single allowance figure which is 6.00 hours per week for non-watchstanders and 4.50 hours per week for watchstanders. It should be reemphasized at this point that the service diversion and training allowance as well as all other SMD allowances assume a condition I/III scenario. Present peacetime underway condition IV and inport condition V enable and require much greater time and emphasis to be placed on the training of crews and individuals. Service diversion time also tends to expand during periods of condition IV and V.

After completion of determination of operational, maintenance, and own unit support manning, and after adding

the various allowances by work center for the ship, the number of billets required is computed by dividing the total man-hours required by the appropriate Navy standard workweek. These workweeks are 66.0 hours for non-watchstanders and 74.0 hours for watchstanders [CNO (OP-124E), undated].

SMD methodology does not provide for measuring or defining the functional workload for officers. The number of officers assigned and their functions are largely determined by fiat.

2. PSMD for FFG-7

The manpower requirements determination and development of the PSMD was conducted in accordance with established SMD methodology for the most part. At various phases of the process, however, provisions were made to account for some of the FFG-7 unique concepts designed to minimize manning requirements of the Class. These concepts were delineated in Chapter II of this thesis.

The initial estimate of manning requirements conducted during the preliminary concept phase of the FFG-7 project utilized a computer-based model, the Manpower Determination Model (MDM). Manning estimates using MDM for various system and subsystem configurations ranged from 220 to 256 personnel. A manning baseline of 220 officers and enlisted personnel was adopted [Nauta, 1978]. During the design phases of the FFG-7 project, further

manning estimates were made ranging from an "austere" manning level of 213 to an MDM estimate of 231 based on an updated ship's equipment list. Citing the requirement to bring followship production costs below target, CNO reduced the accommodations to 185 [Nauta, 1978]. With a five percent growth margin, this set a manning ceiling of 176 officers and enlisted personnel, including the LAMPS aviation detachment. Given the CNO's ceiling on accommodations and manning, SHAPM started the development of the PSMD by tasking the Naval Personnel Research and Development Laboratory (NPRDL) to prepare a PSMD in accordance with the standard SMD methodology early in 1972. SHAPM also tasked Navy Manpower Programs Support Activity (NMPSA) to prepare a manning estimate. The PSMD presented by NPRDL identified 184 required officer and enlisted billets, while NMPSA returned a manning estimate of 213 [Nauta, 1978]. The manning constraint of 176 remained through the commissioning of the OLIVER HAZARD PERRY. The PSMD reflected the ceiling constraint for the first time late in 1972. Subject to constant review, the PSMD received minor revisions, but the total manning requirement was unchanged through commissioning of the leadship. Changes to the PSMD and proposed changes after that event will be discussed in the next chapter. It was the difference between the manpower requirements estimates and the imposed manning constraints that required the

SHAPM to investigate alternatives to reduce the manpower required for the ship class [Nauta, 1978]. These alternatives later became the FFG-7 concepts such as reduced bridge manning due to increased cross-utilization training (proposed Ship Controlman rating), and the Class Maintenance Plan with its progressive overhaul and modular replacement programs [Link, 1980].

The above concepts, and other factors, caused the formulation of the FFG-7 PSMD to be slightly different than those for more traditionally manned ships. Preventive maintenance manning requirements are based upon the quantity and quality of manpower identified by the PM subsystem of the 3-M system. The requirements are summed from the data on MRCs for all equipment. FFG-7 contained many new equipments and received "worst case" substitution Maintenance Index Page (MIP) requirements as the basis for substitution. Where equipments were not covered by PMS the "worst case" substitution was represented by the most demanding maintenance requirements presented due to equipment specifications and reliability.

The PSMD development for FFG-7 adhered to accepted SMD methodology except where deviation was required to conform with the minimum manning concepts of the ship project. The early estimates of manning requirements conformed with SMD methodology, but did not account for the minimum manning concepts of utilization of ship

controlmen to man bridge watchstations, centralization of administrative and supply functions, use of a dedicated deck force for facilities maintenance, and implementation of a class maintenance plan to reduce maintenance manning requirements. Much of the difference between PSMD manning and early manning estimates appear to be the result of manning reductions made possible by these minimum manning practices. Precise comparison is not possible due to the implementation, partial implementation, and non-implementation of the various minimum manning concepts proposed for FFG-7 and assumed in PSMD development.

B. VALIDATION PHASE

1. NAVMMACLANT Procedures

The Navy Manpower and Material Analysis Center (NAVMMACLANT AND NAVMMACPAC) are tasked by CNO to validate all ship manning requirements and prepare a final SMD to replace the PSMD. The validation includes facilities maintenance (FM), preventive maintenance (PM), corrective maintenance (CM), own unit support (OUS), and watch-stations [Royce, 1980].

The on-site validation is carried out by a team of five to eight people who interview supervisors on-board the ship. FM data is gathered by using OPNAV form 1000/28(12-79) (Table III). The only input the ships' supervisors can give is the frequency of an FM function.

TABLE III

FACILITY MAINTENANCE DATA GATHERING FORM

(Activity) (Analyst) (Date)

(Department) (Division/Work Center/Spaces)

FUNCTIONS A	UNIT B	QTY/ AREA C	FREQ. D	CONV. FACTOR E	WEEKLY (DxE=F) F	TIME G	WEEKLY M/H (CxFxG=H) H
POLISH GLASS (Both Sides) (10 SqFt)	Each					.0808	
POLISH GLASS (Sm Portholes)	Each					.0162	
EMPTY TRASH CONTAINER	Each					.0671	
SWEEP	SqFt					.0002	
SWAB	SqFt					.0003	
SWEEP LADDER (10 Steps)	Each					.0236	
SCRUB DECK	SqFt					.0008	
SCRUB DECK GRATINGS	SqFt					.0098	
SWEEP DECK RUBBER MAT	SqFt					.0003	
STRIP AND RE-WAX	SqFt					.0010	
WAX AND BUFF	SqFt					.0010	
VACUUM CARPET	SqFt					.0003	
SHAMPOO CARPET	SqFt					.0028	
CLEAN SCUTTLEBUTT	Each					.0217	

TABLE III Continued

FACILITY MAINTENANCE DATA GATHERING FORM							
(Activity)			(Analyst)				(Date)
(Department)		(Division/Work Center/Spaces)					
FUNCTIONS A	UNIT B	QTY/ AREA C	FREQ. D	CONV. FACTOR E	WEEKLY (DxE=F) F	TIME G	WEEKLY M/H (CxFxG=H) H
CLEAN BRIGHT WORK	LinFt					.0349	
CLEAN DEEP SINK	Each					.0468	
CLEAN LIGHT FIXTURES	Each					.0178	
CLEAN & DISINFECT URINALS	Each					.0441	
CLEAN & DISINFECT COMODES	Each					.0519	
CLEAN WASH BASINS	Each					.0378	
CLEAN & DISINFECT SHOWERS	Each					.0519	
CLEAN MIRRORS	Each					.0013	
CLEAN RAILS & STANCHIONS	LinFt					.0047	
CLEAN MACHINERY SURFACE	SqFt					.0070	
PAINT MACHINERY SURFACE	SqFt					.0170	
PAINT DECK	SqFt					.0071	
PAINT BULKHEAD	SqFt					.0082	
PAINT OVERHEAD	SqFt					.0093	

TABLE III Continued

FACILITY MAINTENANCE DATA GATHERING FORM							
(Activity)			(Analyst)			(Date)	
(Department)		(Division/Work Center/Spaces)					
FUNCTIONS A	UNIT B	QTY/ AREA C	FREQ. D	CONV. FACTOR E	WEEKLY (DxE=F) F	TIME G	WEEKLY M/H (CxFxG=H) H
CHIP PAINT (Hand)	SqFt					.3334	
CHIP PAINT (Machine)	SqFt					.1333	
WIRE BRUSHING	SqFt					.0480	
DUST OR BLOW DOWN & SPOT WIPE OVERHEAD	SqFt					.0011	
WIPE DOWN CABLE RUNS	LinFt					.0023	
WIPE DOWN PIPES	LinFt					.0023	
SPOT WASH (Bulkhds/Overhds)	SqFt					.0045	
DUST DESKS	Each					.0098	
DUST FILE CABINETS	Each					.0043	
DUST EQUIPMENT (CABINETS)	Each					.0097	
DUST BOOKCASES	Each					.0193	
DUST CHAIRS	Each					.0035	

TABLE III Continued

CONVERSION FACTOR

6.0 = Every day (6 day work week)
7.0 = Every day (7 day work week)
3.5 = Every other day
2.0 = Twice per week
1.0 = Weekly
.445 = Twice monthly
.231 = Monthly
.154 = Twice quarterly
.077 = Quarterly
.038 = Semi-annually
.019 = Annually
.010 = Cycle

FREQUENCY TABLE

D6 = 6 Times per day
D = Daily
W2 = Twice per week
M = Monthly
M2 = Twice monthly
Q = Quarterly
S = Semi-annually
A = Annually
C = Cycle

TIME FACTORS

SECONDS =	HOURS	MINUTES =	HOURS	MINUTES	HOURS	MINUTES =	HOURS
10	.003	11	.184	27	.450	43	.717
15	.004	12	.200	28	.467	44	.734
30	.008	13	.217	29	.484	45	.750
45	.013	14	.236	30	.500	46	.767
60	.017	15	.250	31	.517	47	.783
MINUTES	HOURS	16	.268	32	.534	48	.800
1	.017	17	.283	33	.550	49	.817
2	.033	18	.300	34	.564	50	.830
3	.050	19	.317	35	.584	51	.850
4	.067	20	.333	36	.600	52	.867
5	.084	21	.350	37	.617	53	.884
6	.100	22	.367	38	.634	54	.900
7	.117	23	.384	39	.650	55	.917
8	.134	24	.400	40	.667	56	.934
9	.150	25	.417	41	.684	57	.950
10	.167	26	.434	42	.700	58	.967
						59	.984
						60	1.000

PM is validated by taking the number of man-hours required for each system, equipment, or component onboard as listed on the maintenance requirement card (MRC). To this figure a 30 percent make ready and put away allowance and 20 percent productivity factor are added. CM is calculated by using a ratio of one hour CM for every two hours of PM, with the exception of electronics which uses a 1:1 ratio. OUS hours are computed on the basis of work sampling data using Table IV. The following areas are considered OUS: (1) administrative support, (2) command support, (3) supply support, (4) medical support, and (5) utility tasks and evolutions. Watchstation requirements are validated by surveying operational manning requirements as compared to the ROC/POE. Service diversion and training are also figured in using established allowances of 6.00 hours weekly for non-watchstanders and 4.50 hours weekly for watchstanders. These allowances are for condition III steaming. Upon completion of the on-site review, the workload is calculated for each work center and the number of billets required are computed by dividing the productive man-hours available per week by the appropriate Navy standard workweek. The quality of the billets is determined by: (1) pay grade and NEC assigned by the Navy's 3-M (maintenance and material management) system, (2) watchstation qualifications as specified by the Personnel Qualification System (PQS), (3) NECs as determined

TABLE IV

OWN-UNIT SUPPORT WORKSHEETS

OPERATIONAL AUDIT DATA	ACTIVITY, LOCATION	FUNCTION, SUBFUNCTION/CODE, WORK CENTER CODE	COMPLETION DATE PAGE

ACTIVITY TITLE A	RATE B	ACTIVITY FREQUENCY /ITEMS C	CONVER-SION FACTOR D	WEEKLY (CxD=E) E	MANHOURS PER ACCOM-PLISHMENT F	MANHOURS WEEKLY MANHOURS (ExF=G) G	REMARKS H
1. Plan and assign daily work. (Do not include time spent at quarters.) A. 3M - Action B. FM - Action C. AS - Action D. WS - Action E. UT - Action F. EVOL- Action							
2. Check work of subordinates for technical accuracy. (Includes over-seeing work in progress, giving verbal instructions and checking final results.) Daily							
3. Receive direction while attending unscheduled meeting and conferences. (Does not include time alloted under SD&T). A. Divisional - Meeting B. Departmental - Meeting C. Capt. Call - Call D. 3M Meeting - Meeting E. W/C Supervisors- Meeting							

TABLE IV Continued

OWN-UNIT SUPPORT WORKSHEETS

OPERATIONAL AUDIT DATA	ACTIVITY, LOCATION	FUNCTION, SUBFUNCTION/CODE, WORK CENTER CODE					COMPLETION DATE / PAGE

ACTIVITY TITLE A	RATE B	ACTIVITY FREQUENCY /ITEMS C	CONVERSION FACTOR D	WEEKLY (CxD=E) E	MANHOURS PER ACCOMPLISHMENT F	MANHOURS WEEKLY MANHOURS (ExF=G) G	REMARKS H
4. Inspect assigned spaces. Inspections (Note: All inspections should be accomplished during the normal workday and in conjunction with other tasks. This category will include only inspections that are not normally accomplished while performing other functions.)							
5. Supply Functions.							
A. Prepare Supply Requisitions. Units							
B. Maintain Optar Budget. Action							
C. Maintain Consumables. Action							
D. Maintain Data Bank Micofile. Action							
6. Advancement in Rating.							
A. Administer Personnel Advancement Requirements (PAR). Action							
B. Maintain Advancement in Rating Records. Action							
C. Proctor Exams. Action							

TABLE IV Continued

OWN-UNIT SUPPORT WORKSHEETS

OPERATIONAL AUDIT DATA	ACTIVITY, LOCATION	FUNCTION, SUBFUNCTION/CODE, WORK CENTER CODE					COMPLETION DATE PAGE
ACTIVITY TITLE A	RATE B	ACTIVITY FREQUENCY /ITEMS C	CONVER-SION FACTOR D	WEEKLY (CxD=E) E	MANHOURS PER ACCOM-PLISHMENT F	MANHOURS WEEKLY MANHOURS (ExF=G) G	REMARKS H
7. Enlisted Evaluations. A. Draft Enlisted Evals. Eval B. Review Enlisted Evals. Eval							
8. Prepare and maintain PQS Progress Charts. Action							
9. Counsel personnel in Career, Moral, Welfare, and Disciplinary matters. Session							
10. Maintain Watch Qtr. & Sta. Bill. (Includes Bunk & Locker Assign & Watch Sta. assignment.) Action							
11. Process Special Request Chits (Includes time required to research request.) Chit							
12. Maintain Publications & Directives. (Includes all time required to make additions, changes and deletions.) Action							

TABLE IV Continued

OWN-UNIT SUPPORT WORKSHEETS

OPERATIONAL AUDIT DATA	ACTIVITY, LOCATION	FUNCTION, SUBFUNCTION/CODE, WORK CENTER CODE					COMPLETION DATE PAGE
ACTIVITY TITLE A	RATE B	ACTIVITY FREQUENCY /ITEMS C	CONVER-SION FACTOR D	WEEKLY (CxD=E) E	MANHOURS PER ACCOM-PLISHMENT F	MANHOURS WEEKLY MANHOURS (ExF=G) G	REMARKS H
13. Perform duties as Mail Orderly. Action							
14. Operate office equipment. (Includes all time required to operate such equipment as microfische, duplicating equipment and etc.) Action							
15. Training. A. Prepare for training. Action B. Conduct Training Session Session C. Maintain Training Records Action (Note: Includes only time required by Instructor..Training time is incorporated in SD&T)							
16. Correspondence/Messages & Memos. (Does not include reports.) A. Draft Action B. Review Action C. Maintain files. (Includes destroying classified material.) Action							

TABLE IV Continued

OWN-UNIT SUPPORT WORKSHEETS

OPERATIONAL AUDIT DATA	ACTIVITY, LOCATION	FUNCTION, SUBFUNCTION/CODE, WORK CENTER CODE				COMPLETION DATE	
						PAGE	
ACTIVITY TITLE	RATE	ACTIVITY FREQUENCY /ITEMS	CONVERSION FACTOR	WEEKLY (CxD=E)	MANHOURS PER ACCOMPLISHMENT	MANHOURS WEEKLY MANHOURS (ExF=G)	REMARKS
A	B	C	D	E	F	G	H
17. Work Request.							
A. Prepare. Action							
B. Process. Action							
18. Reports.							
A. Prepare. Report							
B. Review. Report							
C. File. Action							
(Note: Obtain listing of reports.)							
19. Logs and Records. (If log/record is prepared on watch, NO time is allowed.)							
A. Prepare. Action							
B. Review. Action							
C. File. Action							
(Note: Obtain listing of logs & records.)							
20. Perform duties of Departmental 3M coordinator. (Note: Administrative duties only.) Action							

TABLE IV Continued

OWN-UNIT SUPPORT WORKSHEETS

OPERATIONAL AUDIT DATA	ACTIVITY, LOCATION	FUNCTION, SUBFUNCTION/CODE, WORK CENTER CODE	COMPLETION DATE PAGE

ACTIVITY TITLE A	RATE B	ACTIVITY FREQUENCY /ITEMS C	CONVERSION FACTOR D	WEEKLY (CxD=E) E	MANHOURS PER ACCOMPLISHMENT F	MANHOURS WEEKLY MANHOURS (ExF=G) G	REMARKS H
21. Utility Task. A. Pick-up and sort division laundry. Action B. Special Watches. (1) Fire, (Welding, cutting, etc.) Watch (2) Fog. Watch (3) Correctional Custody. Watch C. Motion Picture Operations. Showings D. Other Work Action							
22. Evolutions. A. Special Sea Detail. (Includes piloting, anchoring, mooring). B. UNREP. (Includes refueling, reprovisioning, rearming, hi-line or light-line transfer, VERT REP, or any combinations of the above.) C. Operational Detail (Includes visit and search, boarding, and salvage, rescue and assistance, towing, helo operations, lifeguard and plane guard, landing party). D. Working Parties. (Note: Time expended is normally covered under other evolutions.)							

TABLE IV Continued

OWN-UNIT SUPPORT WORKSHEETS

OPERATIONAL AUDIT DATA	ACTIVITY, LOCATION	FUNCTION, SUBFUNCTION/CODE, WORK CENTER CODE					COMPLETION DATE
							PAGE
ACTIVITY TITLE A	RATE B	ACTIVITY FREQUENCY /ITEMS C	CONVER-SION FACTOR D	WEEKLY (CxD=E) E	MANHOURS PER ACCOM-PLISHMENT F	MANHOURS WEEKLY MANHOURS (ExF=G) G	REMARKS H
NOTE: 1. Evolution Stations will be extracted from the SORM. 2. Times will be extracted from the Quartermaster Note Book, SK Records, Oil King records, etc. 3. Frequencies will be obtained from OP-06 via OP-111.							

by the NEC manual, and (4) pay grade distribution necessary to meet rating community flow considerations as determined by Chief of Naval Personnel [CNO (OP-12E), undated]. The total ship manning requirements and those of each work center are then computed using the NMRS computer models.

Although standard SMD methodology and assumptions as well as NMRS are employed in the formulation of a PSMD and its validation by NAVMMAC survey teams significantly different results can be obtained. These differences stem from many sources. Equipments, systems and missions can be changed in the time between PSMD development and validation. Fleet policies for maintenance and watch-stations are subject to revision. Reliability and operating requirements of new equipment can frequently be incongruent with those that were anticipated during PSMD development.

New ships with significant new equipment configurations and manning concepts present more opportunity for variance between PSMD and validation survey requirements. NAVMMAC survey teams can interpret procedures differently and adhere more strictly to published Navy policies than do the writers of the PSMD who can be more conscious of the concepts which may be unique to the new ship project [Betaque, Kennelly & Nauta, 1978].

2. FFG-7 Validation Survey

The FFG-7 and its PSMD validation serves as an example of differences which can arise between PSMD and

SMD requirements. NAVMMACLANT conducted an on-site validation of the PSMD for the FFG-7 at Mayport, Florida 16-20 October, 1978. Based on this survey and further guidance from CNO, NAVMMACLANT prepared a draft SMD for FFG-7 dated 21 June 1979. This draft SMD sets manning requirements at 188 enlisted personnel; an increase of 36 above original PSMD requirements [Royse, 1980]. Some of the recommendations, discussion, and guidance concerning the development of the draft SMD for FFG-7 are contained in the correspondence between CNO and NAVMMACLANT as shown in Appendices A, B, C, and D.

The draft SMD is currently under review and subject to change before final SMD release, preventing the analysis of final SMD and PSMD requirements differences. The recommended requirements changes in the draft SMD include additions to various ratings and divisions due to higher than anticipated workloads. Addition of a postal clerk, a master-at-arms, and a 3-M coordinator are also included in draft SMD recommendations [Royse, 1980].

The manning requirements of the draft SMD reflect major changes to concepts used in PSMD development for engineering and bridge watchstanding during condition III. The draft SMD requires four additional watchstations during condition III in these areas.

Two additional engineering department watchstanders are required in the draft SMD at condition III. These

watchstanders man the forward and after auxiliary machinery rooms (Appendix A). These machinery rooms were designed to be unmanned. The FFG-7, in condition III operations, manned these two watchstations. The watches also served as fire, flooding, and security watches on a roving basis [Pacek, 1980]. The authors' opinion is that these watch-standers were added primarily as a backup to the automatic sensors and operators. Our experience and training has been that automatic devices cannot be fully trusted and that personnel must check them. Electrical and mechanical devices and sensors do fail and become inoperable. On occasions when automatic equipment is not operational the ship will probably be forced to add additional watchstanders to operate and monitor systems which are in a manual mode.

The ship controlman rating has not been approved for FFG-7. This has created the requirement to either formalize the specialized training required or increase billets to allow sufficient personnel to perform the required watch functions (Appendix A). The draft SMD requested a net change of one additional enlisted watch-station and a JOOD to be either an officer or a chief petty officer (Appendix B).

Subsequent review of the draft SMD has recommended elimination of the additional bridge watchstander (Appendix D). These watchstation changes, coupled with the addition of one watchstation in the combat information

center at condition III provide an operational manning increase of 12 to 15 watchstanding billets.

C. METHODS OF MANPOWER REQUIREMENTS COMPUTATION

Several Navy-developed and contractor-developed approaches for improving the Navy's manpower requirements determination have been introduced in recent years. Current SMD methodology incorporates the use of the Navy Manpower Requirement System (NMRS). NMRS was instituted on 1 April 1978 to replace the Computerized Ship Manning Analysis (CSMA) system for the production of SMDs [Concept for Optimizing SMD, undated]. NMRS and other alternative methodologies for manpower requirements determination will briefly be examined, contrasted, and compared in the following section.

1. Manpower Determination Model (MDM)

The MDM was developed in 1967 by the NAVSEC for the purpose of generating ship manning estimates early in the design process utilizing fleet manning data for similar systems/subsystems as proposed for the new ship [Nauta, 1978]. MDM is the method currently used to estimate manning requirements for proposed ship projects. The MDM was originated because the standard SMD methodology was considered too detailed to make manning estimates early in the design phases of a shipbuilding project. MDM utilizes a data base of 7,000 basic modules representing various

equipments, systems, subsystems and ship characteristics. Data are available for DD, FF, DDG, DLG, DLGN, LPA, LKA, AE, AF, AFS, AO, AOE, AOR, MCS, CVA, and CVAN Class ships [Plato, 1975]. The user then chooses a package of modules based on anticipated equipment packages and ship characteristics. This would be modules containing the desired type of ship and its manning requirements coupled with anticipated engineering, weapons, and sensor packages, etc. MDM computes billets required in accordance with standard SMD methodology; using standard allowances, standard workweek, maintenance ratios, etc. Manning requirements are established for each readiness condition. The model then computes a total manning package by comparing the manning requirements for each condition of readiness and ensuring full utilization of each billet. The MDM data base also includes provisions for determining austere as well as conventional manning estimates. Checks against actual ships have indicated MDM has an accuracy of ±5% [Plato, 1975]. This accuracy is in terms of required numbers of personnel only. MDM does not accurately estimate the grade and skill level requirements [Betaque, Kennelly & Nauta, 1978]. The FFG-7 example shows that the MDM estimate of 213 is not within five percent of manning as reflected in the PSMD. The final approved SMD, however, may indicate that the MDM estimate was accurate.

2. Navy Manpower Requirements System (NMRS)

The NMRS is the approved system to be used in developing manning documents for ships and aviation units. The computer-based model computes manning requirements for SMD generation as described earlier in this chapter. Through analysis of manning requirements in the operational, maintenance and own unit support areas at various conditions of readiness, the system generates required billets to: 1) minimize the number of billets, 2) minimize paygrades, 3) minimize NECs, 4) assure assignment of each work and watch requirement to a qualified billet, and 5) assign billet titles [NMRS Functional Overview, 1979]. The NMRS computer programs do have some flexibility to conduct sensitivity analysis. Variables such as work week, productivity allowance, service diversion and training and make ready/put away allowances may be adjusted. SMD generation, however, requires all variables be adjusted to comply with the standard SMD allowances and workweek.

Criticism of the NMRS method is usually focused upon the data base assumptions. Validation of the workloads and allowances used has been sparse. A validation study conducted by NAVMMACPAC in 1978 indicated that the PM and CM data ratios used in SMD formulation were not totally valid. The study results were that: 1) PM requirements were frequently overstated, 2) more CM manhours were consumed than used in the SMD program, 3) PM:CM ratios

varied by rating and ship class, and 4) the study found no apparent mathematical relationship between PM and CM that would predict CM when PM is varied. When the data from the study were used in the SMD process, the SMD manpower implications were positive and negative--the number of billets for some ratings increased while others decreased. However, when compared with the billets authorized by the OPNAV 1000/2, the data almost uniformly indicated increases were necessary if all workload and watch requirements were to be satisfied [NAVMMACPAC, 1978].

The NMRS program has also been criticized as being a static approach to manpower determination. NMRS determines manning according to conditions of readiness without regard to actual anticipated operating schedules.

The most commonly touted alternatives to the NMRS program share many of the features of NMRS. These similarities and differences will be identified for the alternative systems.

3. Tiger/Manning

Tiger is the NAVSEA reliability/maintainability projection model built and operated by NAVSEA. It utilizes mean time between failure and mean time to repair data bases to predict corrective maintenance requirements. The TIGER/MANNING model derives manning requirements based upon corrective maintenance workload. The model mathematically estimates reliability, readiness, and availability

of systems based on the following types of input data: mission data, repair policy, equipment failure data, spares provisioning data, system configuration, and equipment operating rules [Betaque, Kennelly & Nauta, 1978]. The model allows the user to study the effects of corrective maintenance manpower on system reliability, readiness, and availability. Although the Tiger/Manning model can schedule repairmen to stand watch, it does not provide for all required watchstations to be manned [TIGER Manual, 1980]. The model is able to predict utilization of repair personnel and corrective maintenance personnel requirements assuming exponential distributions of both mean time between failure and mean time to repair for various equipments and systems [Betaque, Kennelly & Nauta, 1978]. Because the Tiger model estimates only corrective maintenance manning requirements, it would appear it has only limited applications for the development of manpower requirements for new ships. The data base could possibly provide, however, a better estimate of corrective maintenance requirements than the PM:CM ratios used currently in SMD development.

4. Presearch and Tidewater

Presearch, Inc. and Tidewater Consultants, Inc. each were contracted to develop improved approaches to the SMD system as part of the Navy's Maintenance System Development Project (MSDP). This project is managed by PMS 306, an office of the Naval Sea Systems Command.

The approach developed by Presearch attempts to make the NMRS more dynamic. A Ship Additional Determination and Analysis Module (SHIP ADAM) is used as an adjunct to the NMRS [Technical Comparison, undated]. The process of determining manning requirements starts with the NMRS-generated SMD manpower and imposes a peacetime operational schedule scenario upon the modelled ship. The program allows for and computes idle time and deferred workload by work center as the ship moves through its schedule [Technical Comparison, undated]. Work is deferred based upon priorities inputted by the user. The deferred work is manipulated as necessary to obtain the minimum manning required to accomplish all work.

The Tidewater Consultant approach also depends heavily on NMRS. The Tidewater system also seeks to determine manning requirements for a ship under a typical peacetime operating scenario. The Tidewater approach is similar to the Presearch method. The Tidewater approach seeks to minimize billets based upon changing needs to have idle time and deferred work at various periods during operations. This system is computationally simpler than the Presearch method in that it uses a weighted averaging technique of multiplying workload in a given operating condition of readiness by the percentage of the operational shcedule spent in that condition [Technical Comparison, undated]. The Tidewater system used no major data

collection effort. Data are obtained from the NMRS and other existing data bases.

D. SUMMARY

The accuracy of any manpower requirements determination model is difficult to evaluate. The currently used method is approved by the Navy. It has flaws and weaknesses. The alternative methods which have been presented attempt to solve some of the problems with the current SMD program. None of them appears to be the perfect solution. Most of the Navy's efforts to improve the system still rely on the validity of SMD allowances and ratios. The NAVMMACPAC validation study of PM and CM manning indicated the PM assumptions and the PM:CM ratio are not valid. More work must be done in the area of validation of allowance and ratio values if any method is to reflect accurately the manpower needs of the Navy's ships.

The NMRS model program can be adjusted to allow for different values of the many variables which are now predetermined in SMD formulation. CM manning data can be obtained from the Tiger data base as well as from 3-M reporting data. NAVMMACLANT/PAC survey teams are equipped with the expertise to validate many of the other allowances and assumptions. Accurate reappraisal of CM requirements, PM requirements, PM:CM ratios and allowances would enhance the overall performance of the SMD program.

IV. FFG-7 CLASS FUTURE

This chapter is divided into three sections. The first is concerned with the current status of the FFG-7 Class and many of the original FFG-7 concepts. The second section shows the impact of advanced technology on the experience mix of the Navy's personnel force. The demand for higher quality and experienced personnel could force policy changes away from a reliance on a youthful force. The third section addresses the Navy's efforts to obtain a balance between hardware and manpower trade-offs. We will focus primarily on the Navy's project entitled Military Manpower versus Hardware Procurement (HARDMAN) and its efforts to improve the trade-off balance.

A. CURRENT STATUS

1. Design Constraints

The original ship acquisition plan called for a total of 50 FFG-7 Class ships to be acquired between 1973 and 1979. However, due to concern about the concurrency of leadship and followship construction, early in the program the schedule was stretched-out to provide a two-year gap between delivery of the leadship and the first followship [Nauta, 1978].

Other changes in the procurement program were caused by the CNO decision to increase the number obtained

from 50 to 68, and Congressional reductions in ship construction authorizations and appropriations caused a delay in the procurement timetable. Currently, the program is scheduled for completion in 1988 with the FFG-7 Class then comprising 20 percent of the Navy's surface ships. Due to these changes, the acquisition cost goal of $45 million (FY73) dollars for each followship has increased to $68 million (FY73) dollars [Beecher, 1978].

The Navy was also unable to remain within the original displacement or accommodations constraints. The displacement goal was 3,400 tons, but the FFG-7 has a displacement of 3,645 tons. The CNO originally established 185 accommodations as the limit for the FFG-7 Class. Currently 30 additional bunks are being installed, at the expense of habitability [Nauta, 1978], onto the FFG-7 Class in accordance with the schedule delineated in Chapter II of this thesis. The original design constraints were not met; without these constraints the design of the FFG-7 Class may have grown to the extent that it would not have been acceptable to purchase the Class [Beecher, 1978].

2. Ship Controlman Rating

The design constraints were not the only items not achieved on the FFG-7. Many of her manning concepts were not approved. The development of the ship control rating which would have combined the functional duties and knowledge of the quartermaster, signalman, and boatswain mate

ratings was disapproved. This presents the Class with a problem of either training all new quartermasters, signalmen, and boatswain mates in the complex tasks required during FFG-7 Class bridge watches, or traditionally manning the bridge watch and thereby increasing the SMD requirements [Nauta, 1978].

3. CMP

Another concept that is running into difficulty is the Class Maintenance Plan (CMP). This is basically an educational problem. The FFG-7 Class is an exception to all other ships when it comes to maintenance. The Intermediate Maintenance Activities (IMAs) and the Ship Repair Activities (SRAs) have to treat this Class differently from any other ship. The minimum manning concept of this Class causes a great deal of maintenance to be scheduled for other-than-ship's force [FFG-7/IMAV/SRA Major Modernization Plan, 1980].

Although not part of the CMP, the FFG-7's first Intermediate Maintenance Availability (IMAV) illustrated that a greater level of management is needed during the first few availabilities to ensure material is expedited and procedures are carefully monitored and controlled. A future problem may also be the availability of personnel in the specific NECs needed to support the maintenance program for the FFG-7 Class at the IMAs due to the training pipeline required for these personnel. Other problems

could occur if tools, test equipment, and technical manuals are not supplied to the IMAs and other support groups [FFG-7 IMAV/SRA Major Modernization Plan, 1980].

4. Manning

When the FFG-7 Class was initially designed, it was expected that the ships would be priority manned. (Priority manning means the ship would be assigned its full complement of fully trained personnel as outlined in the SMD.) It was felt priority manning was needed because the PSMD of the FFG-7 was developed at the minimum manned level [Nauta, 1978]. However, the CNO determined it was not possible to priority man the FFG-7 Class, so in the FFG-7's Plan for Use the CNO called for selectively manning the Class to both quality and quantity. This selective manning concept is detailed in Chapter II of this thesis. It should be pointed out that this selective manning is only for commissioning crews and that later crews will be subject to fleet manning policy [FFG-7 Class Maintenance Plan Doctrine, 1979].

Priority manning is generally authorized for new construction units for the first year, deployed units, and submarines [Bentaque, Kennelly, & Nauta, 1978]. The FFG-7 Class is an example of new construction units no longer receiving complete priority manning. These new ships, which are now manned against NMP (Navy Manning Plan) have critical quantitative skill deficiencies between

design manpower and actual on-board personnel and are experiencing difficulties in their post commissioning phase activities [COMNAVSURFLANT, March, 1980].

The manning deficiencies, which manifest themselves as persisting problems in the subsequent years of the ship's life cycle, originate prior to completion of construction. The Navy Training Plan (NTP) prescribed for each new ship has shown a downward migration in quantity and quality of rates assigned. Additionally, assigned personnel frequently arrive on-board late and often without the requisite skills [COMNAVSURFLANT, March, 1980]. The personnel being assigned are also not being as carefully screened, as they were in the past, for disciplinary or administrative problems thus causing ships to bear these problems as well as difficult commissioning work-up tasks [COMNAVSURFLANT, March 1980]. The FFG-7 Class is experiencing these problems as the Navy is unable to fill billet requirements in accordance with crew phasing and planning documents [Fleet Introduction Team, Bath, Maine, Jan. 1980].

In June, 1977 the prospective Commanding Officer (C.O.) of USS OLIVER HAZARD PERRY (FFG-7) addressed the problems of additional manpower requirements for the FFG-7 in a letter to the Ship Acquisition Project Manager (SHAPM) for the FFG-7 Class (PMS-399). In reviewing FFG-7 manning, with the goal of ensuring adequate operator and maintenance

manpower for existing and add-on equipments without compromising the minimum manning philosophy, the prospective C.O. arrived at justification for 28 additional billets [Prospective C.O., 1977].

While not directly responding to the prospective C.O.'s letter, manning authorizations have been increased for the FFG-7 Class. In recognition of the Class's sensitivity to unprogrammed personnel shortfalls in both quality and quantity, the CNO has authorized 16 qualification and training billets for each FFG-7 Class ship. These billets reflect a 10.5 percent increase above the current PSMD level of 152 enlisted billets. These added billets allow a continuing qualification period to accommodate a normal crew turnover. These personnel are to be assigned to the ship for training, watch qualification, and for reassignment to fill urgent unplanned losses [COMNAVSURFLANT, Jan, 1980]. If because of the addition of these billets onboard manning exceeds berthing capacity, the C.O. will have the option of selecting personnel to be transferred on a temporary basis to an afloat or shore command. In the case of deployment, excess personnel could be assigned temporary duty functions in the area and at the halfway mark in the deployment report to the deployed ship. The replaced personnel are then sent ashore for temporary duty until the ship returns to its homeport [COMNAVSURFLANT, Sept. 1978].

In addition, because of feedback from COMNAVSURFLANT and NAVMMACLANT's recommendations (based on a manpower survey visit of the FFG-7 16-20 Oct., 1978), CNO has programmed an additional 20 enlisted billets for the FFG-7 Class in the Program Objective Memorandum (POM) for fiscal year 1981. These 20 billets seek to minimize the impact of unforecasted losses, provide upward mobility, and provide flexibility in accomplishing unscheduled corrective and facilities maintenance [Bruce, 1979]. This manpower growth consists of increasing funded billets to 189 enlisted, which breaks down to 173 enlisted plus 16 qualification and training billets [CNO, 1980]. The bunk alteration for an additional 30 bunks as described in Chapter II will increase enlisted accommodations to a total of 198 bunks and therefore be able to handle the increased manpower.

The Navy currently mans its ships according to the Navy Manning Plan (NMP). The NMP allows for the manning of ships based upon the actual total number of Navy personnel available worldwide as well as the individual ship requirements as specified in the SMD or PSMD. Generally, the number of personnel available in the manpower pool for NMP assignment is somewhat less than the SMD requirements to operate the ship [Bentaque, Kennelly, & Nauta, 1978]. The developers of FFG-7 Class had requested priority manning for the Class for its entire

life-span but did not obtain it. The methodology used in developing the FFG-7 PSMD arrived at a minimum figure of 152 enlisted personnel. The developers felt that the figure could not be further reduced. The loss of priority manning means that the Class will receive only its "fair share" of available personnel assets. The authors therefore believe that the increase in billets above the original 152 serves to increase the chances of the ship being actually manned to original PSMD levels under the NMP. Information garnered from interviews conducted in the Washington, D.C. and Norfolk, Va. areas was interpreted by the authors as revealing that 152 was a sufficient number of personnel to successfully operate the ship.

5. Capabilities

The FFG-7 Class has multi-mission capability similar "in-range" to a traditional DD/DDG; however, capability is limited "in depth" in many mission areas. These constraints are imbedded in hardware, organization, and manning of the ship [Mann, 1979]. It is the opinion of the authors that the FFG-7 Class is a capable class of ships which can be employed in convoys, battle groups, etc. However, the FFG-7 Class should not be required to escort an aircraft carrier and act as the plane guard ship. The FFG-7 Class has limitations that should be adhered to so the commanding officer is not placed into a "can do" or "must do" environment.

The Fleet must understand the exceptions of the FFG-7 Class. With the minimum-manned bridge, the FFG-7 Class cannot handle the typical two communication nets, maneuvering board, tactical publications, challenge and reply, visual signalling, and the daily routines all at once. If the Fleet recognizes this as a fact, then the bridge manning can be reduced. If, on the other hand, the Fleet requires the bridge of the FFG-7 to perform the same as those of the DD-963 or DDG-2, then additional manpower will be required on the bridge [Mann, 1979].

One final area of Fleet education, in regards to the FFG-7 Class, must be mentioned. The FFG-7's "push as much paper" as other ships. Inspectors come aboard expecting the same results as they would on a DD-963 or FF-1052 Class--each one of those Classes having more personnel than the FFG-7 to devote to the administrative workload. For example, in an FF-1052 Class ship, condition III engineering watchstations drive a total of nine senior petty officers and chief petty officers billets who are available inport to administrate and manage division/ work center PQS (Personnel Qualification System), PMS (Planned Maintenance System), and other requirements which are not measured in the SMD methodology. With fewer condition III watchstations, the FFG-7 Class does not have these senior personnel available; however the same administrative/management programs are required. This is

counter to the minimum manning concept since "pushing paper" does not increase combat capability. The "peacetime" management of administrative and support requirements needs to allow the FFG-7s to be an exception to a portion of this sort of workload rquired of other ships [Mann, 1979].

B. MILITARY EXPERIENCE LEVEL

1. Manning Comparison

The FFG-7 Class Project office (PMS 399) conducted a study in January, 1980 providing comparisons among the manning of the five most recently delivered destroyer-type ships. Their results in terms of billet quality and quantity are shown in Table V [PMS 399, 1980].

The numbers in Table V were obtained from the ships' SMDs or PSMDs. The figures indicate that while all of these new destroyer-type ships are petty officer intensive, the FFG-8 has the highest percentage (69.5) of E-4 and above personnel. It should be noted that the numbers for the FFG-8 do not include the 16 qualification and training billets (all E-4 or above), or the 20 POM-81 recommended billets (6 E-2/3s and 13 E-4 or above). Also not included in Table V are the helicopter (LAMPS) detachment billets or those personnel who will be required upon addition or modification of current equipment [PMS 399, 1980].

Table V

Enlisted Manning Comparisons

Pay Grade	DD-968	%	FF-1052	%	DDG-2	%	FFG-1	%	FFG-8	%
E-9	-	-	1	.4	1	.3	1	.4	1	.5
E-8	4	1.5	3	1.2	6	1.8	3	1.2	2	1.2
E-7	14	5.0	11	4.5	18	5.4	13	5.4	11	6.6
E-6	33	12.2	36	15.0	39	11.7	36	15.1	23	13.8
E-5	51	18.8	42	17.4	68	20.5	42	17.6	37	22.2
E-4	75	27.7	63	26.1	93	28.0	65	27.3	42	25.2
E-2/3	93	34.8	85	35.4	107	32.3	78	33.0	51	30.5
TOTAL	270	100.0	241	100.0	332	100.0	238	100.0	167	100.0

2. Youth-Oriented Policies

Binkin and Kyriakopoulous [1979] have pointed out that the military forces of today are primarily youth-oriented and each year the armed forces are the nation's largest single employer of youth. They point to several factors that constitute the basis for this heavy reliance on youth. First, the military has traditionally set a premium on "youth and vigor," largely on the grounds that military occupations demand high levels of physical fitness. Second, the military personnel management system, geared to a traditional pyramidal rank structure, has shaped a force characterized by a high rate of turnover. This is often referred to as the "up or out" concept. This has created a requirement for large numbers of young people, who by and large are not expected to serve beyond one enlistment period. Third, a youthful force has long been considered a less expensive force (a draft philosophy). Fourth, the practice of cycling many of the nation's youth through the active military forces enlarges the mobilization base by providing a source of manpower for U.S. reserve components. Finally, a military system in which a large number of youngsters serve temporarily has also been measured in terms of its benefits for society.

These factors listed above seem to contradict the trend of the newly developed ships, listed in Table V, that call for many highly technical experienced personnel.

The aviation community has also experienced a rise in demand for skilled labor. For example: the F-15 program procured highly sophisticated automatic test equipment to do the fault diagnosis of avionic boxes and sub-assemblies. These test stations go down on the average of every 34 operating hours, and because of their complexity, 50 percent of the failures experienced have never occurred before. The learning curve is flat, it takes 5 to 6 years of on-the-job training (OJT) and experience to become proficient in operating these stations. The Air Force has hired contractors and government service employees to assist the military maintenance personnel [Shorey, 1980]. The impact of a youthful policy, combined with low retention, can be evidenced by examining the experience shortfalls of the FFG-11 shown in Table VI [COMDESRON TWELVE, 1980].

Table VI

FFG-11 Experience Shortfalls

Billet Number	Rate Allowed	Paygrade Allowed	Paygrade Assigned
E-221	MR	E-5	E-3
CS-303	FT	E-6	E-3
CS-304	FT	E-5	E-1
CS-307	FT	E-4	E-1
CS-309	FT	E-4	E-2
CS-310	FT	E-4	E-1

3. Costs

If the Navy hopes to keep pace with technology, it is evident it needs to rely on skilled, experienced specialists and technicians. One of the by-products of the advancements in technology is extensive training programs. In its fiscal 1979 budget, the Department of Defense requested $5.9 billion dollars to operate its training establishment. An example of the high cost of billets due to increased training requirements can be seen from Table VII [PMS 399, 1980].

Table VII

Enlisted Billet Comparisons Cost (FY 79 Dollars)

Ship Type	Qty	Avg. Cost/Year Per Man
DD-968	271	$18,934
FF-1052	241	$18,159
FFG-8	167	$19,328
DDG-2	332	$18,702
FFG-1	238	$18,812

The FFG-8 data do not include the cost of the 16 qualification and training billets, the 20 additional billets recommended in POM-81, or the helicopter (LAMPS) detachment. It also does not consider the cost of

training shore personnel to adequately support the Class as dictated by the Class Maintenance Plan. The high costs indicated in Table VII increase if personnel are not retained and replacements are required [PMS 399, 1980].

C. HARDWARE VERSUS MANPOWER

In 1976 the Senate Armed Services Committee requested the Secretary of the Navy to evaluate and improve the integration of planning, requirements determination, training, allocation, and assignment of military civilian and reserve manpower in the Navy. With the rising cost of manpower, the Senate desires to ensure that manpower is affordable and available during the design of any new system [Watkins, 1977].

1. HARDMAN

In response to this request, the "Military Manpower versus Hardware Procurement Study" (HARDMAN) was initiated. The study was to analyze compatability of the manpower and training requirements determination functions within the Weapons System Acquisition Process (WSAP) [CNO, 1978].

The HARDMAN study found that: (1) Plans and analysis for manpower and training occurred too late in the WSAP; (2) WSAP directives and instructions do not provide systematic policies for manpower and training consideration (65 directives); (3) Deficiencies exist in the development of training plans needed to support a

new system (80% are late and 25% were unfunded in POM-78); (4) Project managers and principal development activities require greater incentives to address manpower issues; and (5) Analytical tools are required to conduct tradeoff analysis [Watkins, 1977].

In response to these findings the CNO established the HARDMAN project office (OP-112). This office is to develop a program that will institutionalize the requirement to consider the manpower and training impacts on the WSAP [CNO, 1978]. As a part of the HARDMAN process development, Dynamics Research Corporation (DRC) was contracted to develop a prototype version of the HARDMAN methodology for assessing manpower and training requirements. The prototype methodology has five major steps: (1) establish a consolidated data base; (2) perform manpower requirements analysis; (3) perform personnel/training requirements analysis; (4) conduct impact analyses; and (5) determine potential trade-off areas and repeat the methodology. This prototype methodology has been applied to the Shipboard Intermediate Range Combat System (SIRCS) and the LSD-41 propulsion system. In order to be fully evaluated more applications of this prototype methodology are required [Dynamics Research Corporation, 1979].

The HARDMAN office is currently involved in a series of meetings designed to both inform the larger manpower and hardware communities about the progress of

the HARDMAN project and to solicit feedback and support of exploratory concepts which will be pursued in the future by the HARDMAN office. These meetings hopefully will provoke communication between manpower and hardware experts. Then a process can be devised which early on identifies the manpower problems in today's systems and the systems on the drawing board, the manpower implications of the design changes, and manpower costs now and in the future [Sovereign, 1980].

2. Other Efforts

In addition to the efforts of HARDMAN, several weapons systems projects have the consideration of the impact of their proposed systems upon manpower and training requirements among their objectives. The F-18 and the F-16 aircrafts, the Pershing II (a medium range ground-to-ground missile system), Patriot (a high and medium altitude air defense system), and AEGIS (an air surveillance and defense system) have attempted to reduce or constrain maintenance manpower requirements in numbers and skill [Shorey, 1980].

Weapon system programs can affect manpower savings through a combination of three different approaches. One approach is to reduce the frequency of maintenance demands through the use of improved materials, higher reliability components, and design simplification. A second approach is to reduce the task times and skill requirements for

maintenance actions by: (a) improving accessibility, (b) making troubleshooting easier through automated and built-in test equipment, (c) improved technical manuals, and (d) training. Finally, new support concepts, such as the elimination of maintenance levels or consolidation of repair at centralized points, can lead to significant manpower savings [Shorey, 1980].

It is too early in the development of these systems to determine if their program efforts have been fully successful. There are still problems in these programs such as the lack of techniques which can relate measured results to manpower attributes, and a lack of measures of manpower effectiveness. Despite these problems, the recognition by the designers of new weapons systems that manpower is a problem is a step in the right direction [Shorey, 1980].

D. SUMMARY

The first portion of this chapter discusses the problems encountered by the FFG-7 in regards to its design concepts. The second and third sections address the problem of advancing technology and manpower and training requirements. The increase in the quality and cost of personnel due to advanced technology have caused the Navy to establish the HARDMAN project office in an attempt to establish a process where manpower and training requirements are considered early in the WSAP. The Navy can no

longer enjoy the luxury of assuming that its manpower and training requirements can be satisfied from inexhaustible resources at an acceptable cost. Practically every WSAP decision has manpower, personnel, and training implications. Manpower related costs are the single most significant requirement on the Navy's resources [CNO, 1978].

V. CONCLUSION AND RECOMMENDATIONS

USS OLIVER HAZARD PERRY (FFG-7) was commissioned in December of 1977. The ship is the leadship for the FFG-7 Class destroyer. The total number of ships to be procured for this Class has fluctuated, but 68 are currently planned. When completed in 1988, the FFG-7 Class will comprise 20 percent of the total number of the Navy's surface ships.

A. CONCEPTS

There are many unique aspects of the FFG-7 program which distinguish it from traditional ship programs. The FFG-7 design constraints, its organization, mission and characteristics, maintenance, and manning concepts all vary from tradition.

1. Design Constraints

a. Design-to-Cost

The Perry (FFG-7) Class was the first design-to-cost ship acquisition program. The design-to-cost process is similar to the earlier design-to-requirements program, but cost is recognized as a design parameter in the design-to-cost system. Cost goals are established early during the ship design and are subjected to trade-offs with schedule and performance. The FFG-7 was designed with a construction cost goal of $45.7 million and a limit

of $50 million in fiscal year 1973 dollars. Since the leadship (FFG-7) has been built the cost for each followship in the Class has increased to $68 million (fiscal year 1973) dollars.

b. Displacement

The FFG-7 displacement goal was the second major design constraint. In order to remain within the $45 million goal, the CNO set a displacement goal of 3,400 tons and a limit of 3,600 tons fully loaded. While the FFG-7 exceeded this goal (3,645 tons), without a displacement goal it may have risen to an unacceptable level.

c. Accommodations

Cost again played an important role in determining the number of accommodations on the FFG-7 Class ships. The CNO directed that there would be 185 bunks in order to reduce life cycle costs, particularly manpower. The FFG-7 leadship experience has caused 30 additional bunks to be added to the ships of this Class. This addition is at the expense of designed crew habitability. The bunk alteration will be conducted as delineated in Chapter II of this thesis.

2. Organization

a. Departments/Divisions

The FFG-7 Class varies from tradition in the organization of its departments. Unlike the traditional

frigate the FFG-7 has the following departments: (1) combat systems; (2) ship control/communications; (3) support; (4) aviation; and (5) engineering. The only officers assigned to the ship control/communications, and support departments are the department heads. The role of the division officer is assumed by the senior enlisted petty officer in each division. The FFG-7 deck division also has its differences from tradition. Personnel in this division stand no underway watches. The facilities maintenance (FM) program onboard increases deck division's responsibility to include the cleanliness and maintenance of all topside and common-use spaces.

b. Watchstations

Design technology has enabled the designers to reduce the number of condition III watchstations. In the engineering department most propulsion, electrical, and damage control equipment is started and operated by a two-man watch in the central engineering control station. Advanced technology has also led to the elimination of the requirement for watchstations in the auxiliary machinery spaces. However, the need for watchstations in the auxiliary machinery spaces for security and safety reasons is still being discussed and no decision has been made (See Appendices). Another issue currently under discussion is the number of personnel required during the FFG-7 condition III bridge watch. Designers, in an attempt to reduce the number of bridge watchstations from the

traditional 11 or 13 enlisted personnel and two officers to one officer and five enlisted personnel, developed a ship controlman rating. This rating would combine the functional duties and knowledge of the quartermaster, signalman, and boatswain mate ratings. This new rating was disapproved by the Navy. The exact number of personnel required for condition III bridge watches has yet to be determined (See Appendices).

c. Systems Training

Each of the ship's departments is structured on a system training concept. The system is stratified into the senior systems technician, the senior enlisted technician, the subsystem technician, and subsystem component technician, which includes the apprentice technician. This stratification allows for the development of technicians in pipelines that call for little or no personnel cross-utilization or equipment cross-training.

3. Mission and Characteristics

The FFG-7 Class was built to help provide the level of escort capability required in the 1980's and beyond. The FFG-7 Class was part of a shipbuilding concept which will provide a spectrum of ships. The DD-963 Class were designed to be small in number but very capable ships operating in high threat areas. The FFG-7 Class, on the other hand, was to be smaller, but still effective, lower cost and be used for less demanding tasks. For example, the DD-963 Class is designed for escorting

aircraft carriers while FFG-7 Class is designed for escorting underway replenishment groups, amphibious forces, and commercial shipping to protect them against subsurface, air, and surface threats.

The Perry Class is a gas-turbine powered, single-screw guided missile frigate comparable in size to the FFG-1 Class, but manned by a smaller crew. A list of the ship characteristics is given in Table I. In addition, there are already plans to retrofit the Class with more advanced technical equipment.

4. <u>Maintenance</u>

The Class Maintenance Plan (CMP) for the FFG-7 includes several unique characteristics. The first of these is the recognition that the requirements for many maintenance tasks can be estimated. These estimates form the schedule for all ship's maintenance availabilities. The second characteristic is that all intermediate and depot maintenance is expected to be accomplished during more frequent availabilities of three to four week duration (progressive overhaul) rather than at lengthy regular overhaul periods which last from 6-12 months. The third characteristic makes use of the CMP to anticipate equipment failure so modular replacement can be scheduled prior to the need for corrective maintenance. The fourth characteristic is to make use of repair-by-replacement rather than conventional piece-part repair

methods. Because of the FFG-7 being a two-year lead-ship, the CMP has not been completely implemented or tested.

5. Manning

The FFG-7 was designed for the minimum amount of personnel required. It was expected that the ship would be priority manned. Priority manning means the ship would be assigned its full complement of fully trained personnel as outlined in the SMD. Instead the CNO called for selectively manning the FFG-7 Class. Nineteen new FFG-7 unique NECs have been directed by the CNO to be manned to both quality and quantity. In addition, 67 billets should be manned to quantity in the rating specified, but without regard to pay grade. The remaining 67 billets are to be manned in accordance with fleet manning policy. This selective manning concept described above applies to only commissioning crews and later crews will be subject to fleet manning policy.

In recognition of the FFG-7 Class's sensitivity to unprogrammed personnel shortfalls in both quality and quantity, the CNO has authorized an additional 16 qualification and training billets for each FFG-7 Class ship. These personnel are to be assigned to the ship for training, watch qualification, and for reassignment to fill urgent unplanned losses. Feedback from COMNAVSURFLANT and NAVMMACLANT (based upon the FFG-7 leadhsip experience)

has caused the CNO to program an additional 20 enlisted billets for the FFG-7 Class in POM-81.

The Navy currently mans its ships according to the Navy Manning Plan (NMP). The NMP allows for the manning of ships based upon the actual total number of Navy personnel available worldwide as well as the individual ship requirements as specified in the SMD or PSMD. The original PSMD of the FFG-7 called for 152 enlisted billets. Increasing the number of authorized enlisted billets to 189, the authors believe, serves to increase the chances of the ship being manned at minimum level under the NMP.

B. RECOMMENDATIONS

1. Policy Alternatives for Skilled Personnel

The minimum manning concept for the FFG-7 Class produces a large demand for highly skilled personnel both on the ships and in the shore establishments. In our opinion, there are several alternatives that could be developed to meet this demand.

a. Civilianization

Civilianization of shore billets is one action to support the maintenance programs and fill the unique NECs required for the FFG-7 Class. There are two sources of civilian labor: (1) direct-hire employees of DoD, and (2) contract hires, who work for private-sector firms under contract to DoD [Beltramo, 1974]. A cost-effectiveness study is required to determine if either one

of these sources of manpower is feasible. Binkin, Kanter, and Clark [1978] list the costs that should be considered in such a study. These civilians could free the NEC trained military man for sea duty.

b. Lateral-entry

Another possible area for policy change is lateral-entry into the military from the civilian world. This would eliminate much of the skill training from the military. It would also enable the military to recruit to fill shortages in specific rates and NECs.

c. "Up or Out" Policy

The Navy's "up or out" policy also eliminates some highly skilled personnel. The "up or out" policy requires personnel to advance to supervisory roles and increased responsbility, or leave the service. Some technicians do not desire to be supervisors or accept the increased responsibility. The loss of these technicians hinders the Navy's efforts to fill technical ratings to both quantity and quality.

d. Proficiency Pay

It costs the Navy a good deal of money to train personnel with technical NECs. If these personnel depart the military has to recruit and train a replacement. The money spent for these replacements should be used to pay a proficiency salary, bonus, or other benefits to highly skilled workers. This increase in pay or benefits

would lessen the lure of civilian companies with large payroll promises.

2. <u>FFG-7 Class Improvements</u>

a. Priority Manning

The authors feel the FFG-7 Class should have received priority manning rather than selective manning. The designers were faced with constraints in cost, displacement, and accommodations. One of their assumptions was that the Class would receive priority manning. Using this assumption, the designers developed the ship with the minimum amount of personnel required. If the FFG-7 Class had received priority manning, perhaps the need for the 16 qualification and training billets and 20 additional billets requested in POM-81 would not exist.

b. Ship Controlman Rating

The designers of the FFG-7 Class, working under the minimum manning concept, reduced the number of personnel required in condition III bridge watches. In reducing the quantity of personnel on watch, the quality of those remaining was assumed to increase. The ship controlman rating would have combined the functional duties of the quartermaster, signalman, and boatswain mate ratings. The authors feel that the ship controlman rating should be approved. If not, at least a new NEC should be developed that would train personnel in the quartermaster, signalman, and boatswain mate ratings.

The FFG-7 should not be required to have a traditional bridge watch.

c. Class Maintenance Plan (CMP)

The FFG-7 CMP requires this Class of ship to be treated differently from other ships by the IMAs and SRAs. Based on the experience of the leadship of the Class, the authors believe a greater level of management is needed to ensure material is expedited and procedures are carefully monitored and controlled. In our opinion, it is also essential that the support activities receive the necessary skilled personnel, tools, test equipment, and technical manuals in order to make the CMP a success. It is also assumed that sufficient spares are purchased, and that the operating scenarios will return the ships regularly to shore-based or tender maintenance facilities.

3. HARDMAN

The authors agree with the concepts of the HARDMAN project office. A program is needed to fully consider the manpower and training impacts on the WSAP. Perhaps if the HARDMAN prototype methodology had been used on the FFG-7 Class the need for 16 qualification and training billets; 30 additional bunks; and the need for the 20 proposed growth billets would have been recognized early in the design of the system. Procedures to establish communication between manpower and hardware experts, not just a

review process, are needed. Communication forums (similar to the Hardware-Manpower trade-offs meeting of 12-13 March, 1980), are necessary to exchange information between hardware and manpower communities. Some of the appropriate Naval communities are: (1) all Deputy Chiefs of Naval Operations (DCNOs); NAVMMAC (Atlantic and Pacific); Naval Personnel (NAVPERS); Navy Education and Training (NET); Commanders/Atlantic and Pacific fleets); and 3-M personnel.

4. SMD Recommendations

a. Condition III

When developing a SMD, it is assumed that wartime cruising (Condition III) is the most manpower demanding condition. The authors would also like to see the manning requirements by in-port workload (Condition V) determined. Because of the limited availability of some personnel in-port (due to leave, liberty, etc.), it would be prudent to identify deferred workload and assign it to the off-shore support units as necessary.

b. PM:CM Ratio

The authors feel from their experience and research that the PM:CM ratio used in the SMD process is not a true reflection of workloads required by CM and PM. In our opinion, CM should be an independently calculated workload element rather than one derived from PM. This

will require expansion of data collection in order to establish a CM data base. Some of the data required may be found in the Tiger CM and 3-M data bases.

c. Other Allowances

The prescribed allowances for service diversion and training are about one-half the ten to twelve hours per week fleet commanders say are required [Bentaque, Kennelly, & Nauta, 1978]. This allowance and the others used in the SMD process, need to be reevaluated. Validation of these allowances and assumptions will enhance the reliability and accuracy of the SMD process.

APPENDIX A

7T:1272/cm
5310
Ser 1823/7
15 NOV 1978

From: Commanding Officer, Navy Manpower and Material Analysis Center, Atlantic
To: Chief of Naval Operations (OP-11)

Subj: USS OLIVER HAZARD PERRY (FFG-7) Preliminary Ship Manpower Document (PSMD) Validation; preliminary report of

Ref: (a) CNO ltr Ser 124E/695524 of 25 May 1978
(b) PSMD for FFG-7
(c) Conversation between LCDR SANEK, NAVMMACLANT, and CDR LIVINGSTON, CP111C1 of 24 Oct 1978

Encl: (1) Problems and Recommendations

1. Pursuant to reference (a), the on-site phase of the validation of the PSMD for USS OLIVER HAZARD PERRY (FFG-7), reference (b), was conducted at Mayport, Florida during the period 16-20 October 1978. During the on-site review, the survey team identified a number of problems or perceived problems in the PSMD which can be addressed effectively while a revised draft SMD is still under development. In response to a request conveyed in reference (c), enclosure (1) contains a description of these problems, together with recommendations for their resolution.

2. Several of the deficiencies discussed in enclosure (1) have a common basis. The ship was designed for reduced manning of the ship control function on the premise that a new rating, Ship Controlman, would be established. Since the proposed rating has not been approved, the billets provided for the enlisted bridge watch team are a mixture of SM, QM and seaman billets the incumbents of which, in this ship, have had extensive cross-training prior to the commissioning of the ship. There is a requirement either to institutionalize such training for future crews or to provide additional billets which will afford the necessary quartermaster and signalman rating skills for the respective watch functions.

E. F. COX
Acting

AD-A091 093 NAVAL POSTGRADUATE SCHOOL MONTEREY CA F/G 5/9
ANALYSIS OF MANNING DECISIONS AND CONCEPTS UTILIZED FOR THE FFG--ETC(U)
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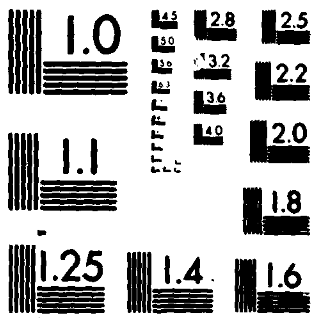

MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

FFG-7

PROBLEMS AND RECOMMENDATIONS

1. Problem. The PSMD does not provide for a JOOD at Condition III; however, a JOOD is considered necessary.

a. Discussion. The ship control console lacks components to allow a one-officer watch on the bridge. Design features lacking in the console include collision-avoidance/ computer-associated radar, adequate all-around visibility, and integrated navigational equipment, which is located around the bridge in a similar fashion to non-minimum manned ship bridges. Additionally, the signal bridge, bridge, CIC, communication and display design is felt to be unsatisfactory for managing/maintaining a tactical picture from CIC.

b. Recommendation. It is recommended that the JOOD watch be manned at Condition III; E-7 is considered to be the minimum pay grade required.

2. Problem. The Navy does not have a program to provide the necessary training for the seamen required for bridge watches on the FFG-7.

a. Discussion. Due to the disapproval of the ship controlman rating concept, the ship requires a formal training pipeline to ensure that seamen standing bridge watches are qualified to rotate through the bridge watch stations, which requires them to be capable of operating the integrated bridge console. While SM is considered the minimum qualification, the SN can attend formal QM and SM training to indoctrinate him in his duties. A possible alternative to the proposed ship controlman rating would be to establish an NEC to identify the unique training requirements for that SN. A less desirable alternative would be to man the bridge with a traditional watch which would drive three additional billets. This is not desirable because of the reduced-manning concept of the FFG-7 design.

b. Recommendation. It is recommended that a formal training pipeline and an NEC, vice rating, be established. If this is not feasible, then a traditional bridge watch is recommended.

3. Problem. The PSMD does not provide for a POOW at Condition III; however, a POOW is considered necessary.

a. Discussion. A nonrotating enlisted watch supervisor is required to maintain the deck log, compass log, weather log, the drafting of weather messages, omega navigation and D/R plotting in addition to supervising and administering to the routine needs of the enlisted watch section.

b. Recommendation. It is recommended that the POOW be manned at Condition III; a QM2/SM2 is considered to be the minimum requirement.

4. Problem. The PSMD does not provide for an Assistant Visual Communicator/Messenger; however, the watch station is considered necessary.

a. Discussion. Due to the restricted open bridge visibility and unsatisfactory design of the "signal shack" within the ship control area an assistant visual communicator is considered necessary to perform the duties associated with wartime steaming visual communications in a Condition III environment. By combining the duties of bridge messenger with the assistant visual communicator it is felt a savings of three billets can be realized.

b. Recommendation. It is recommended that the Assistant Visual Communicator/Messenger be manned with a SMSN.

5. Problem. The PSMD does not provide for a billet in the unmanned equipment room; however, a billet is required.

a. Discussion. The ship is not equipped with remote systems status indicators in CIC for its sophisticated electronics equipment. Due to the mission essentiality of the OJ-172/UYK, AM/UYK/20, MK-92 Servo control cabinet, AIMS MX XII IFF, AN/SPS-49 and the cooling water systems, a Data System Casualty Control/System Monitoring Operator is required at Condition III.

b. Recommendation. It is recommended that a Data Systems Casualty Control/System Monitoring Operator be manned at Condition III with a DS2 minimum requirement.

6. Problem. The PSMD does not provide for a Forward Equipment Operator/Monitor; however, one is considered necessary.

a. Discussion. A Forward Equipment Operator is required to monitor, start, stop and shift machinery in auxiliary machinery rooms #1 and #2. He is also a fire, flooding and security watch. The equipment located in #1

and #2 auxiliary machine rooms includes reefer plants, freeze boxes, chill boxes, SSDG auxiliary fuel transfer system, A/C plants, fire pumps, HP/LP air compressors and educator systems.

b. Recommendation. It is recommended that the Forward Equipment Operator/Monitor be manned at Condition III with an ENFN minimum.

7. Problem. The PSMD does not provide for an After Equipment Operator/Monitor, however, one is considered necessary.

a. Discussion. An After Equipment Operator/Monitor is required to monitor, start, stop and shift machinery in the engine room and auxiliary machinery room #3. He also acts as a fire, flooding and security watch. The equipment he is responsible for includes the gas turbines, reduction gear, lube oil purifier, CHT system, main lube oil system, SSDG, distilling plants, HP/LP air compressors, and eductor system.

b. Recommendation. It is recommended that the After Equipment Operator/Monitor be manned at Condition III with an EN3 minimum.

8. Problem. The PSMD does not provide for a Postal Clerk to maintain the ship's post office.

a. Discussion. The functional workload associated with the maintenance and operation of the post office is sufficient to warrant the assignment of a permanent PC3 to the ship. The assignment of this workload to a YN de-emphasizes the strict management control of the PC requirements and further detracts from the available manpower assigned for administrative support in the central office complex concept of reduced manning.

b. Recommendation. It is recommended that a PC3 be assigned to the ship to administer the mail and maintain the postal duties.

9. Problem. Consideration has been given to the proposition that a CICWO might be necessary at Condition III, although one is not provided in the PSMD.

a. Discussion. The PSMD displays billets for a TAO and CIC supervisor. A CICWO billet filled at Condition III would allow the TAO to devote his full attention to weapons system employment without detraction from his duties required in the supervision of the CIC watch section duties involving TG communications, station-keeping

recommendations and surface contact picture for bridge team assistance.

b. Recommendation. It is not recommended that the CICWO be manned at Condition III. The assignment of a TAO and CIC watch supervisor eliminates any functional workload or supervision requirement for another billet in CIC. The manning of these two billets is adequate to fulfill the ship's requirements until Condition I is required, at which time the CICWO is also manned.

10. Problem. Consideration has been given to the proposition that a 61JS sound-powered phone talker may be required at Condition III, although one is not provided in the PSMD.

a. Discussion. The sonar stack operator can not function on watch while wearing sound-powered phones. A 61JS phone talker is therefore required to pass sonar contact information to the bridge and CIC.

b. Recommendation. It is not recommended that a 61JS sound-powered phone talker be manned at Condition III, a 29MC foot-operated microphone with speakers on the bridge and in CIC is available for passing sonar contact information and is sufficient until Condition I stations are manned.

APPENDIX B

Ser 111C11/272261
Jun 04 1979

From: Chief of Naval Operations
To: Commanding Officer, Navy Manpower and Material Analysis Center, Atlantic

Subj: USS OLIVER HAZARD PERRY (FFG-7) Preliminary Ship Manpower Document (PSMD) Validation; guidance concerning

Ref: (a) CO NAVMMACLANT ltr 7T:1272/cm 5310 ser 1823/7 of 15 Nov 1978

1. Reference (a) addressed ten areas of concern with the FFG-7 PSMD, identified during NAVMMACLANT's on-site survey/validation of USS OLIVER HAZARD PERRY (FFG-7), considered to be of sufficient gravity to warrant CNO guidance before the development of a draft SMD.

2. Each problem area has been reviewed by CNO and the following comments/guidance are provided and keyed to the recommendations as set forth in enclosure (1) to reference (a):

-1- CONDITION III JOOD: The watch is valid, however, it is to be manned by a ship's company officer.

-2, 3, 4- ENLISTED BRIDGE WATCH REQUIREMENTS: To alleviate this problem an additional watch station has been identified. The following is a list of valid Condition III enlisted bridge watch stations (minimum requirement indicated in parentheses):

Station

- QMOW/POOW (QM3/SM3)
- Ship Control Console (SCC) Operator (SN)
- Signal Supervisor (SMSN)
- Messenger/Recorder (SN)
- Port Lookout (SN)
- Starboard Lookout (SN)

The additional watch station should provide for a QMOW/POOW and provide flexibility to rotate on watch personnel. No NEC will be assigned SC-1 personnel.

-5- CONDITION III DATA SYSTEMS CASUALTY CONTROL/ SYSTEM MONITORING OPERATOR WATCH: This watch is not considered to be a valid watch station requirement.

-6, 7- CONDITION III EQUIPMENT OPERATOR/MONITOR WATCH (FORWARD AND AFT): These are valid watch stations and should be identified in the draft SMD. Minimum requirements are forward (ENFN), aft (GSM3).

-8- PC3 BILLET: This is a valid requirement to be identified in the draft SMD.

-9- CONDITION III CICWO: This is not a valid requirement, however, in order to allow the CIC watch supervisor to provide his full attention to his supervisory duties an additional OS watch station (ASAC) is considered to be a valid requirement. The following is a list of valid enlisted Condition III CIC watch stations (minimum requirement indicated in parentheses):

Station

- CIC watch supervisor (OS1)
- ASAC (OS2)
- Surface detector/tracker (OSSN)
- Air detector/tracker (OSSN)
- DRT Operator (OSSN)

-10- CONDITION III 61JS TALKER: This is not deemed to be a valid requirement.

3. The above information should resolve those FFG-7 PSMD problems raised as a result of the on-site validation. Accordingly, it is anticipated that the FFG-7 draft SMD will be distributed prior to 15 June 1979.

W. G. Eason
By direction

APPENDIX C

Ser 111C1/678531
JAN 14 1980

From: Chief of Naval Operations
To: Commanding Officer, Navy Manpower and Material Analysis Center, Atlantic

Subj: USS OLIVER HAZARD PERRY (FFG-7) Ship Manpower Document (SMD)

Ref: (a) Draft SMD for USS OLIVER HAZARD PERRY (FFG-7) of 21 Jun 1979
(b) USS OLIVER HAZARD PERRY (FFG-7) Draft SMD On-site Review Conference of 13 Dec 1979

1. The in-depth review of reference (a) identified several areas in which the validity of the initial NAVMMACLANT documentation effort was contested by FLT/TYCOM staff and ship representatives (reference (b) refers). Based on the comments of review conference attendees, the following major issues and deficiencies in reference (a) were identified:

a. Planned Maintenance System (PMS) requirements have been reduced significantly from that contained in the PMS package used to develop the draft SMD.

b. Utilization of ratios (Planned Maintenance (PM) to Corrective Maintenance (CM)) to derive CM manpower requirements is an illogical procedure in view of the availability of CM data for the entire ship.

c. Ship departmental and repair party organizations reflected in reference (a) are not in conformance with the organizations contained in CNO's FFG 7 "Plan for Use", OPNAVINST C9000.4, and the FLT/TYCOM approved Battle Organization Manual for FFG 7 class ships.

d. Five divisions (Ship Control, Communications, Deck, S-1 and S-2) do not have division officers assigned. Required administrative and command support workload normally performed by a division officer is therefore assigned to the senior enlisted billet in the division. This workload is not documented by the draft SMD.

e. Minimum rate requirement for the Console Operator Watch during Condition III should be E-4 vice E-3.

f. Staffing of the Ship Control Division is deemed to be inadequate to accomplish the assigned workload because billets in the draft SMD do not provide minimum qualitative requirements to perform all bridge functions properly. For example, documentation of SN vice QMSN/SMSN billets does not provide a sufficient number of properly trained personnel for periodic relief/rotation of bridge watches within a watch section.

g. E8/9 rather than E6 ship 3M Coordinator is required due to the maintenance management responsibilities associated with the billet.

h. Visual signal watch can be adequately maintained by one (1) SM assisted by other on-watch personnel when required, therefore the necessity of recorder watch at Condition III is questionable.

i. CPO (E-7) staffing in the DC/AUX Division is viewed as excessive with three CPOs (EMC, HTC and ENC) assigned.

j. Manning the after Battle Dressing Station with a Medical Technician (HN) is considered invalid. Requirement can supposedly be met by an individual properly trained in routine first aid.

3. In order to provide precise manpower documentation for the ship, survey of and/or validation of workload data associated with the aforementioned areas is deemed necessary. It is requested that this tasking be completed not later than 15 February 1980. Issues/workload which cannot be validated by NAVMMACLANT are to be referred to CNO (OP-111) for resolution.

C. D. Fellows
By Direction

APPENDIX D

7-200/psm
5310/2
Ser 0388/7
25 MAR 1980

From: Commanding Officer, Navy Manpower and Material Analysis Center, Atlantic
To: Chief of Naval Operations (OP-111)

Subj: USS OLIVER HAZARD PERRY (FFG-7) Ship Manpower Document (SMD)

Ref: (a) CNO ltr ser 111C1/678531 dtd 14 Jan 80
(b) USS OLIVER HAZARD PERRY (FFG-7) Draft SMD On-Site Review Conference of 13 Dec 79
(c) Draft SMD for USS OLIVER HAZARD PERRY (FFG-7) dtd 21 Jun 79 (NOTAL)
(d) OPNAVINST C9000.4 (FFG-7 Plan for Use) (NOTAL)
(e) COMNAVSEASYSCOM ltr ser 1354 dtd 15 Sep 75 (FFG-7 Class Ship-Preliminary SMD) (NOTAL)
(f) CO, NAVMMACLANT ltr ser 1823/7 dtd 15 Nov 78 (NOTAL)
(g) CNO ltr ser 111C1/272261 dtd 4 Jun 79 (NOTAL)
(h) OPNAVINST 3120.32
(i) NAVPERS 18068D, Navy Enlisted Occupational Standards, Section I, Change 5, Jan 79
(j) CNO SMDGRAM 75-9 dtd 20 Mar 75 (NOTAL)
(k) SMDLANT 78-35 dtd 26 SEP 78 (NOTAL)
(l) OPNAVINST C3501.XXX (Draft POE/ROC for the FFG-7 Class Ship) (NOTAL)

1. Reference (a) tasked this command to revalidate selected workload data associated with the FFG-7 class ship. This tasking was generated as a result of reference (b) which followed FLT/TYCOM staff and ship review of reference (c), the draft SMD. The revalidation has been completed; the following recommendations are provided and keyed to the issues as set forth in paragraph 1 to reference (a):

a. Planned Maintenance System (PMS) requirements for the FFG-7 class ship were made available in December 1979 and thus not incorporated in reference (c) when written. They will be incorporated in the final SMD for this ship upon resolution of the issues addressed at the on-site review conference.

b. With regard to utilization of Planned Maintenance (PM)/Corrective Maintenance (CM) ratios, it is recommended that the use of the ratio for Planned Maintenance (PM) to Corrective Maintenance (CM) be retained for the following reasons:

(1) As a result of two on-site validation efforts, it has been determined that all CM carried out on the ship is not being fully reported, and what is being reported, is unfortunately not in a form suitable for use in SMD development. This data is forwarded to COMNAVSEASYSCOM (PMS 399) for application to equipment reliability and does not detail who actually performed the CM. Although the CM can usually be identified with a particular work center, in most cases it cannot be identified with a particular rating when the work center contains multiple ratings, or to a particular rate within a rating.

(2) The documented CM does not represent a normal period in the lifecycle of a ship. On-site validation has confirmed that a substantial amount of CM is associated with correcting initial design deficiencies which are unique to new construction ships, and should be non-recurring.

It is therefore recommended the PM/CM ratio continue to be used until completion of the present effort by COMNAVSEASYSCOM to establish an independent functional workload standard for CM.

c. The ship's departmental organization will be changed to reflect incorporation of reference (d) which was not originally distributed to this command. Reference (c) was initially developed displaying ship organization as reviewed in on-site validations. Issue (c) also indicates that the repair party organizations are not in conformance with the organizations contained in the FLT/TYCOM Battle Organization Manual for FFG-7 class ships. The Battle Organization Manual for this class has not been approved but is in a draft status. It is recommended that the repair parties identified in an approved FLT/TYCOM Battle Organization Manual be incorporated in the final SMD.

d. Administrative and command support workload relative to enlisted personnel performing Division Officer duties cannot be validated by originator at this time. The problem is compounded because required Division Officer workload has not been defined for any condition of readiness. On Perry, collateral duties that are

traditionally assigned to Division Officers have been divided among the department heads and senior enlisted personnel in the Ship Control and Supply Departments. Although the workload associated with some of these collateral duties can be substantial, the responsibility for accomplishment of this work cannot arbitrarily be assigned at the Division Officer level, since the majority of collateral duties have no particular minimum required skill level. It is further questionable whether a large number of the traditional collateral duties could be considered valid Condition III work elements.

Issue (d) is therefore referred to CNO (OP-111) for resolution. In order to help define the assignment of administrative and command support workload to enlisted Division Officers, it is recommended that the ship FM/OUS Data Base Manager be tasked to identify collateral duties that are considered to be valid for a Condition III environment and to establish a minimum skill level for each.

There is one other problem area associated with the three enlisted division officers assigned to the Ship Control Department (BM, RM, AND QM rates). Reference (f), based on the first Perry on-site validation in October 1978, recommended this Condition III JOOD watch be added with a minimum skill level of E-7. Reference (g) approved this watch, upgrading the skill level to a commissioned officer, although at the time, the ship's current manpower authorization did not include sufficient officer billets to support this watch. During reference (c), COMNAVSURFLANT concurred in the need for this watch, asking it to be identified as an officer/CPO requirement. Since SMD methodology only assigns the minimum required skill to a watch station, originator will recommend, by separate correspondence, that this watch station be formally approved, with a minimum skill level of E-7. In actual practice, Perry is using the three Ship Control Department enlisted division officers to fill this watch requirement. This watch requirement, on top of the dual hat of enlisted Division Officer/senior enlisted billet, is excessive, since SMD methodology normally assigns 30 hours/week of Own Unit Support to the senior enlisted billet in each rate, and the additional 56 hours/week for a Condition III watch exceeds the Standard Navy workload of 74 hours/week for a Condition III watchstander. If the Condition III JOOD watch is approved at a skill level of E-7, it is recommended that this watch be assigned in the final SMD to a QMC, BMC, and RMC, and that the staffing tables for these three rates be modified for the FFG-7 to ensure that the second senior enlisted billet in these rates be at least an E-6, to ensure adequate division supervision.

e, f, and h.

The FFG-7 Ship Control Department was initially designed to have a Ship Control Division that would be responsible for fulfilling all bridge and visual communications Condition III watch requirements. It would be staffed with personnel possessing a new Ship Controlman rating encompassing both QM and SM training. The Ship Controlman rating, relevant NEC, and/or training pipeline for this function has not been established. The physical arrangement of the ship control spaces on Perry prohibits a traditional bridge watch. Reference (e) proposed five Condition III watches for this ship: ship control console operator, a visual communicator, a communications recorder, and two lookouts. As initially intended, all five of these watches would be Ship Controlmen, which would meet minimum watch station requirements, and allow for the required bridge watch rotation in accordance with reference (h). Since the Ship Controlman rating concept has not been implemented, or a training pipeline established to support the unique bridge watch station requirements of the FFG-7, an attempt was made to man these stations with traditional rates. In accordance with normal SMD methodology, minimum skill levels for these watches are as follows:

Ship Control Console Operator	- Undefined
Visual Communicator	- SMSN
Lookouts (2)	- SN
Communications Recorder	- SN

The Ship Control Console operator replaces the following watches on a traditional bridge:

	Minimum Requirement
Helmsman	SN
Engine Order Telegraph Operator	SN
Talker (1 JV)	SN
Throttleman	MM3

Perry has fulfilled this requirement through on-the-job training, and has recommended a minimum skill level of QM3, which is concurred in. Attempts by the Perry to use E-3's in this watch have proven unsatisfactory. This watch encompasses not only the helmsman and throttleman skills, but is also the primary communication link between the OOD and the rest of the Condition III watches, and is responsible for steering casualty controls since after steering is unmanned at this condition. In general, the watch requires someone with an adequate overall knowledge

of the ship's capabilities. From practical experience, a QM3 is the best fit from the present rating inventory for this responsibility. Perry, again from practical experience, has determined that this watch must be rotated. Reference (f) recommended a sixth bridge watch, a POOW, which would fulfill the functions normally assigned to the BMOW and QMOW on a traditional bridge. This recommendation was approved by reference (g), with a minimum skill level of SM3/QM3, and incorporated in reference (c) with a skill level of QM3 to permit proper watch rotation with the Ship Control Console Operator.

In addition, during reference (b), it was determined that the communications recorder was not required, since the ship can adequately maintain the required visual communications watch using one SM assisted by other on-watch personnel as required. The only personnel available for this assistance are the lookouts. For this reason, it is recommended that the minimum skill level for the lookouts (2) be upgraded from SN to SMSN. This will enable the communicator and two lookouts to rotate as required by reference (h). This is close to what was envisioned in the initial intent of the FFG-7 program, that is, that the lookouts be knowledgeable of the SM rate. This also eliminates the problem of having SN lookouts with no possible relief, since there are no other SN watches with which to rotate, as required by reference (h). The following Condition III Ship Control Watches are recommended with associated minimun skill levels:

POOW	- QM3
Ship Control Console Operator	- QM3
Visual Signal/Messenger	- SMSN
Lookouts (2)	- SMSN

It is further recommended that once the issues for the Ship Control Division are resolved, that a unique staffing standard, combining the QM and SM ratings, be developed for the FFG-7 class ship. Unless otherwise directed, originator, designated as Watch Station Data Base Manager, will initiate this action, separately, upon issue resolution.

g. During reference (b), it was concurred in by all attendees that the billet for the 3M Coordinator be upgraded from an E-6 to a minimum of E-8. Following rationale was offered:

(1) FFG-7 is a "fully reporting ship" and documents CM; the 3M Coordinator's functional workload is therefore substantially increased.

(2) The 3M Coordinator's position is, fundamentally, a management position vice a technical position. In accordance with reference (l), the minimum management position in the enlisted billet structure exists at the Senior Chief level. Following revalidation, this command recommends the 3M Coordinator billet be retained at the E-6 level. Although the increased responsibility in rationale (1) is acknowledged, total documented workload for this billet is 33 hours/week. The 3M Coordinator is not responsible for the initiation and preparation of CM supporting documentation, but only for the implementation and management of the program on board. The additional responsibility of ensuring CM is properly documented is well within the general capabilities of an E-6, as defined in reference (i). Originator supports the concept proposed in rationale (2). However, the paygrade of this billet, using normal SMD methodology has traditionally been established based on the total PM workload of the ship, with billet seniority directly proportional to the PM package, as follows: (PM figure includes a 30% Make Ready and Put Away Allowance applied to the raw PM data extracted from the Planned Maintenance System):

Pay Grade	PM (Hrs/Week)
E-6	1000
E-7	1500
E-8	2000
E-9	2500

This table has been approved by CNO (OP-11). Although the responsibility of the 3M Coordinator is somewhat unique on FFG-7 because of the "fully reporting concept," it is not unique enough to have the present approved table overridden by the definition of an E-8 as promulgated in reference (i). If reference (i) is the overriding consideration, the 3M Coordinator billet in all SMD's should be changed to a minimum of E-8. To upgrade this billet on the FFG-7 two paygrades, introduces an inconsistency in the SMD program that is not supportable by the uniqueness of this billet's responsibility on the FFG-7 class ship. Additionally, CNO (OP-111) has indicated that the use of reference (i), in SMD development, is to be used as a guide only, and is not an authoritative source document with hard, fast restrictions. If OP-111 determines that reference (i) is the determining consideration, it is recommended that reference (j), which established the present table, be cancelled, and OP-111 establish the 3M Coordinator at the Senior Chief level, as a directed requirement on all Navy ships.

i. This issue stated that the assignment of three E-7 billets to the DC/AUX Division appears excessive. This issue was addressed by the Warfare Sponsor and was raised because of CPO berthing limitations on the FFG-7 class ship, although habitability constraints are not a consideration in determining valid manpower requirements. However, originator concurs that this staffing is excessive, and was caused by a combination of the following elements:

(1) The HTC and ENC billets are driven by documented PMS requirements that call for specific PM actions to be performed by personnel at the E-7 level. The 3M system has traditionally been an inviolate cornerstone of the SMD program, and it is recommended these two billets be retained at the E-7 level. If the Perry can justify reducing the skill level required for these PM actions via the 3-M Feedback Reporting System, it will automatically reduce the skill level in the SMD program.

(2) The EMC billet is driven by the use of CNO-approved standard staffing tables. The present staffing standards for the HT, EN, and EM rates were developed envisioning these rates in separate divisions (R, A, and E divisions). Combining these three rates into one division results in an excess of supervisory capability using standard staffing tables. It is recommended that the EMC billet be downgraded to an EM1 billet. CNO resolved a similar problem with EM's in the RASE division on selected SURFLANT/SURFPAC replenishment ships in reference (k). Recommend the EM staffing table in reference (k) be utilized for the DC/AUX Division on Perry.

j. Documented workload on Perry supports one HM. Reference (b) contains two HM's, the second to support the After Battle Dressing Station at Condition I only. This was based on originator's interpretation of Required Operational Capability (ROC) element FSO 10.1, in reference (l), which requires a full capability at Condition 1. Disucssion with the NAVSURFLANT Force Medical Officer indicates the purpose of the After Battle Dressing Station is to serve as a contingency back-up in the event the Main Battle Dressing Station becomes inoperable, and was not intended to be manned at Condition I by the HM rating. It is recommended the second HM billet be deleted. Using the HM standard staffing tables, this will reduce the HMC billet to HM1, and delete the HN billet entirely.

K. W. DONOHOE
By direction

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